MEASLES IMMUNIZATION COVERAGE AND DROPOUT RATE ON CHILDREN BETWEEN 6 MONTHS AND 14 YEARS IN THE CITY OF TSHWANE, HAMMANSKRAAL

By

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DEDICATION

This dissertation is dedicated to my beautiful family

Naledi, Gaopalelwe and Kgalalelo

for their love, invaluable support and motivation.

Student number: 56517491

DECLARATION

I declare that **MEASLES IMMUNISATION COVERAGE AND DROP-OUT RATE ON CHILDREN BETWEEN 6 MONTHS AND 14 YEARS IN THE CITY OF TSHWANE, HAMMANSKRAAL** is my own work and that all the sources that I have used, cited or quoted have been indicated and acknowledged by means of complete references, and that this work has not been submitted before for any degree at any other institution.

Signature:……. **Date:** 17 February 2021

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MEASLES IMMUNISATION COVERAGE AND DROPOUT RATE ON CHILDREN BETWEEN 6 MONTHS AND 14 YEARS IN CITY OF TSHWANE, HAMMANSKRAAL

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ABSTRACT

Measles is a highly contagious virus that can affect the entire population if an effective immunisation programme is not in place. This study was aimed at determining the measles immunisation coverage and the dropout rate among children aged between 6 months and 14 years and at assessing factors associated with caregivers' knowledge and perception of, and attitude towards the measles immunisation programme. Between 14 May 2018 and 31 July 2018, a descriptive, cross-sectional study design was conducted using simple random sampling to sample 381 caregivers of children at nine public health facilities at Tshwane Sub-district 2, Hammanskraal town. Data were collected by means of a structured questionnaire and observational checklist, and analysed using IBM SPSS version 23.0. Overall, the measles immunization coverage was 95.8% (365/381) and the MCV1-MCV2 dropout rate was 4.1%. The association between educational level and employment status (*correlation coefficient*=0.157**, *p=0.0002*), measles knowledge (*correlation coefficient*=-0.244**, *p=0.000*), immunization importance (*correlation coefficient*=-0.194**, *p=0.000*) and measles vaccine schedule (*correlation coefficient*=-0.138**, *p=0.007*) were found to be significant at $p<0.05$. The findings in this study revealed that caregivers' positive attitude towards, and knowledge of measles immunisation programme resulted in high measles immunisation coverage and low dropout rate. It is recommended that continuous positive immunisation education about the benefits and importance be emphasized in order to increase immunisation uptake.

KEY TERMS

Measles immunisation coverage, dropout rate, measles vaccine, caregiver, knowledge, attitude, perception, measles, measles outbreak, correlation, educational level

MOENTO WA MMOKO LE TSHELEGELO YA ONE MO BANENG BA DIKGWEDI TSE 6 GO YA GO DINGWAGA TSE 14 MO TOROPONG YA TSHWANE, HAMMANSKRAAL

TSHOBOKANYO

Mmoko ke kokwanatlhoko e e tshwaetsang gagolo ka tsela e e ka amang batho botlhe ga porograma ya moento e e tlhwatlhwa e se maemong. Thuto eno e diretswe go bontsha moento wa mmoko ka namana le tshelegelo ya one mo baneng ba ba dikgwedi tse tshelelago ya go dingwaga tse 14 le go ela tlhoko tse di amang kitso ya batlhokomedi, boikutlo le pono ya bone ka porograma ya moento wa mmoko. Mogare ga 14 Motsheganong le 31 Phukwi 2018 tlhaloso le thuto ya ditshwantsho e ne e tshwerwe go dirisiwa disampole tse di farologaneng go tlhopha batlhokomedi ba le 381 ba bana mo mafelong a botlhe a boitekanelo mo Dika-tikologong tsa Tshwane, mo Hammanskraal. Tshedimosetso e tserwe ka tsela ya go dira potsolotso le ka tshekatsheko ya lenaane go dirisiwa IBM SPSS version 23.0. Moento wa mmoko fa o kopanngwa e ne dira 95.8% (365/381) le MCV1-MCV2 go tswile 4.1%. Dipalopalo magareng ga thuto le boemo jwa tiro (*coefficient ya kgolagano*=0.157**, *p*=0.0002), kitso ka mmoko (*coefficient ya kgolagano*=-0.244**, *p=0.000),* botlhokwa jwa moento *(coefficient ya kgolagano=-0.194**, p=0.000),* thulaganyo ya kalafi ya mmoko *(coefficient ya kgolagano=-0.138**, p=0.007)* di iponaditshe di dira ka *p<0.05.* Dipoelo tsa thuto e, di rebotse gore boikutlo jo bosiameng jwa batlhokomedi, le kitso ka porograma ya moento wa mmoko di bontshitse gore moento wa mmoko ka namana o kwa godimo le tshelegelo e kwa tlase. Go tlhotlhletswa gore thuto ya moento ee siameng e fiwe gangwe le gape go gatellwa botlhokwa le mosola ka mabaka a go oketsa tiriso ya moento.

DINTLHAKGOLO

Moento wa mmoko, palo ya tshelegelo, kalafi ya mmoko, batlhokomedi, kitso, boikutlo, pono. Mmoko, tshelegelo ya mmoko, kgolagano, thutego

KU FIKELELA KA NSAWUTISO WA SWIMUNGWAMUNGWANA NA NHLAYO YA LAVA TSHIKEKE EKA VANA LAVA XIKARHI NGA TIN'HWETI LETI 6 NA MALEMBE YA 14 EKA DOROBA RA TSHWANE, HAMMANSKRAAL

NKATSAKANYO

Swimungwamungwana xitsongwa-tsongwani lexi tlulelaka swinene lexinga hangalakaka na rixaka hinkwaro loko kungari na nongonoko wa nsawutiso lowu endliwaka. Nkambisiso lowu u endleriwe ku kumisisa ku fikelela ka nsawutiso wa swimungwamungwana na nhlayo ya lava tshikeke eka vana lava xikarhi nga tin'hweti leti 6 na malembe ya 14 na ku kambisisa swivangelo leswi fambisanaka na vutivi bya mukhathaleri, langutelo na matwisiselo eka nongonoko wa nsawutiso wa swimungwamungwana. Exikarhi ka 14 May na 31 July 2018 ku endliwe nkambisiso lowu hlamuselaka wa xiphemu ku tirhisiwa xikombiso xo olova xa xitshuketa ku hlawula vakhathaleri lava nga 381 va vana eka tindhawu ta 9 ta vutshunguri ta mani na mani ta Tshwane Exiphenwini xa muganga wa 2, a Hammanskraal. Rungula ri hlengeletiwe hi ku tirhisa swivutiso leswi nga hleriwa na nxaxamelo wa leswi nga xiyiwa na ku kambisisiwa hi ku tirhisa IBM SPSS ya muxaka wa 23.0. Hi ku angarhela ku fikelela ka nsawutiso wa swimungwamungwana a ku ri 95.8% (365/381) na nhlayo ya lava tshikeke ya MCV1-MCV2 a ku ri 4.1%. Ku fambisana exikarhi ka mpimo wa dyondzo na xikhundlha xa ntirho (*nhlayo ya ku fambisana*=0.157**, *p=0.0002*), vutivi bya swimungwamungwana (*nhlayo ya ku fambisana*=-0.244**, *p=0.000*), nkoka wa nsawutiso (*nhlayo ya ku fambisana*=-0.194**, *p=0.000*), xiyimiso xa nsawutiso wa swimungwamungwana (*nhlayo ya ku fambisana*=-0.138**, *p=0.007*) swi kumeke swi xiyeka eka *p<0.05*. Mbuyelo wa vulavisisi wu komba leswaku kutiyimisela ka kahleka vahlayisi loko switа eka vutivi bya nsawutiso wa swimungwamungwana swi endla leswaku kuva na nsawutiso lowukulu naswona nhlayo yo lava tshikaka yile hansi. Swa

hlohleteriwa leswaku kuva na dyondzo leyi yaka emahlweni ya mbuyelo wa kahle xikan’we na nkoka lowu tiyisisiwaka leswaku kutava na tlakuka ka nsawutiso.

TIDYONDZO TA NKOKA

Ku fikelela ka nsawutiso wa swimungwamungwana, nhlayo ya lava tshikeke, nsawutiso wa swimungwamungwana, mukhathaleri, vutivi, langutelo, matwisiselo. Swimungwamungwana, ku tangunuka ka swimungwamungwana, ku fambisana, mpimo wa dyondzo.

LIST OF ABBREVIATIONS

ABM	Andersen's Behavioural Model
BCG	Bacille Calmette-Guerin
CDC	Centres for Disease Control and Prevention
DTaP-IPV-Hib-HBV	Diptheria, tetanus and acellular pertussis vaccine + inactivated polio vaccine + Haemophilus influenza type B vaccine combined.
EPI-SA	Expanded programme of immunization in South Africa
ID	Identity number
ISHP	Integrated School Health Policy
MCV	Measles containing vaccine
MCV1	Measles containing vaccine 1st dose
MCV2	Measles containing vaccine 2nd dose
MR	Measles and Rubella
NDOH	National Department of Health
NICD	National Institute of communicable Disease
OPV	Oral Polio vaccine
RtHB/C	Road to Health Booklet or Card
RV	Rotavirus
SIAs	Supplementary Immunization Activities
SMS	Short Message Services
SPSS	Statistical package of social sciences
Td	Tetanus and reduced-strength diphtheria vaccine
WHO	World health Organization

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CHAPTER 1

ORIENTATION OF THE STUDY

1.1 INTRODUCTION

Progress has been made in increasing measles-containing vaccine coverage in South Africa. However, some children have been immunized partially, especially in Gauteng, due to gaps in immunisation programs, resulting in low immunisation coverage (Ndwandwe, Nnaji, Mashunye, Uthman & Wiysonge 2020:4). These disparities in the access to and use of the vaccine persist globally, resulting in global re-emerging measles outbreaks (World Health Statistics 2020:7). The measles immunisation coverage and dropout rate were, therefore, assessed in this study in order to find gaps that hinder the improvement of measles immunisation coverage (Mathiarasu, Raman & Arumai 2017:27).

Listening and acknowledging community issues and concerns is very important in dealing with a public health crisis. The decision to vaccinate a child is dependent on a parent and the influence of the community. Some parents refuse to vaccinate their children, especially for measles, due to a fear of vaccine safety, bad experiences and being misinformed by the media. The researcher, therefore, assessed the knowledge, attitude and perceptions of the vaccine-preventable disease as the most important factors in influencing immunisation practices (Matta, El Mouallem, Akel, Hallit & Khalife 2020:1).

In this chapter, the researcher discussed the background of possible causes of low measles immunisation coverage and high dropout rate in Hammanskraal between children aged six months and 14 years. The research problem statement, aims and objectives of the study were also addressed. The significance of the study addressed the urge of the researcher to choose the topic. Brief outlines of the research methodology and data analysis, followed by discussions of the findings and conclusions, are also discussed. An outline of the dissertation is included to indicate its features.

1.2 BACKGROUND OF THE RESEARCH PROBLEM

Measles is an acute illness caused by the measles virus – Morbilivirus. This disease is highly contagious and can affect an entire population if an immunisation programme is not in place (South African National Department of Health (NDOH) 2015:1). The illness starts with a fever, followed by a runny nose and red eyes. Later on, a rash of tiny red spots breaks out (CDC 2016:1). Transmission from an infected person is via droplets from the nose, mouth and throat. Measles can be prevented by immunisation as there is no specific treatment – only symptomatic management with recovery within two to three weeks. Measles can have fatal complications such as brain damage, middle ear infections and malnutrition, which may lead to deafness, blindness, general malaise and decreased physical activity, and can impact children's cognitive and physical development negatively (Anekwe, Newell, Tanser, Pillay & Barnighausen 2015:5020; WHO 2017:209).

The Global Measles and Rubella Strategic Plan 2012-2020 set a goal for measles elimination in five of six WHO regions by the end of 2020. Milestones were also targeted by the end of 2015 to reduce and maintain annual measles incidence to less than five cases per one million in order to achieve at least 90% coverage with the first routine dose of the measles-containing vaccine nationally, exceed 80% district immunisation coverage and at least 95% measles immunisation coverage during supplementary immunisation activities (SIAs) in every district (WHO 2012:13). In this strategic plan, effective surveillance was also established to monitor the disease, evaluate progress and maintain outbreak preparedness, responding rapidly to and managing cases (WHO 2012:21).

Even though the Global Measles and Rubella Strategic Plan 2012-2020 saw a sizeable measles reduction, only 82 countries out of 178 member states achieved measles elimination goal. Hence the Global Measles and Rubella Strategic Framework 2021-2030 reinforced by envisioning a world free of measles for all WHO regions (WHO 2020:8). Measles immunisation is highly effective, safe and cost-effective if properly implemented. Interrupted measles transmission has been demonstrated in developed countries compared to developing countries such as

Africa with immunisation coverage being the key indicator for monitoring health sector performance (Sartorius, Cohen, Chirwa, Ntshoe, Puren & Hofman 2013:174). Developed countries depend on national research and data to set their policies, whereas developing countries adhere to modified World Health Organization guidelines (Davis & Mbabazi 2017:2). However, measles is still the leading cause of death in vaccine-preventable diseases globally (Abad & Safdar 2015:1). An increase in immunisation coverage and a reduction in the dropout rate can reduce measles outbreaks; hence, the likely cause of the 2009-2011 measles outbreak in South Africa, which was depicted to be due to the failure of adequate vaccine coverage (Ntshoe, McAnerney, Archer, Smit, Harris, Tempia, Mashele, Singh, Thomas, Cengimbo, Blumberg, Puren, Moyes, Van der Heeven, Schoub & Cohen 2013:2).

A lack of evidence for measles immunisation coverage and the dropout rate in Hammanskraal in Tshwane Region 2 compelled the researcher to conduct this study. A similar study exploring the knowledge, attitude and perception was conducted by Mphaka, Moshime and Reddy (2018:221); however, it did not stipulate the gaps that result in low measles immunisation coverage in the region. Hence, in undertaking this research, the researcher anticipated the positive influence this study will have in generating and transforming knowledge that will benefit society as a whole(Penfield, Baker, Scoble& Wykes 2014:22).

One of the main challenges in the South African Expanded Programme of Immunisation (EPI-SA) programme is that, in 2015, the government introduced a new expanded programme/schedule for immunisation in South Africa. The measles vaccine was initiated at six months of age and followed up by a booster vaccine at 12 months of age (NDOH 2015:1). During that transformation, there was a huge misinterpretation of information and a lack of proper storage practices to which most of the health care workers did not adhere, which was mainly due to insufficient in-house training provided to health care workers regarding the administration of the newly introduced vaccine and huge stock-out(Hossain, Mokaya & Mugoya 2017:1; Bateman 2016:319). The additive effects of all these factors led to recent low levels of measles immunisation and outbreaks, which have been predicted to be future occurrences if immediate and adequate measures are not taken. Therefore, in this

study, the levels of immunisation coverage and dropout rate were determined as measures to prevent future outbreaks.

1.3 PROBLEM STATEMENT

1.3.1 Immunisation coverage

South Africa achieved 89,2% for immunisation coverage in 2015/2016, whereas Gauteng achieved above 100%, with the Tshwane District also on target with 83,4% (Health System Trust 2016:397). However, the country experienced a measles outbreak in 2017. This may be due to suboptimal immunisation coverage, which is the cause of the national struggle with outbreaks of vaccine-preventable diseases (Mahery & Slemming 2019:76).

1.3.2 Foundations of a measles outbreak

The City of Tshwane had measles incidence among approximately 100 infants per 10 000, which clearly demonstrated that during the sporadic occurrence of the measles outbreak in 2009 to 2011, the Tshwane metropolitan area was the first, with a high attack rate significantly as a result of a high concentrated population density and poor immunisation coverage (Sartorius *et al* 2013:179). Moreover, in Gauteng, there were six cases of laboratory-confirmed measles from the Ekurhuleni District, the City of Johannesburg Metro and the City of Tshwane Metro from January 2014 to December 2014 (National Institute of Communicable Disease (NICD) 2015:1). Gauteng Health MEC Gwen Ramokgopa also confirmed a measles outbreak of 17 cases where 13 cases were in Johannesburg and three in Tshwane with one in the City of Ekurhuleni (*Eye Witness News*, 7 May 2017). Even though data are available for provinces and districts, there is no available data for small towns such as Hammanskraal. Therefore, this study is aimed at determining and describing the possible bases of a measles outbreak, measles immunisation coverage and the dropout rate with a view to eliminating measles in the Tshwane health district.

1.4 RESEARCH PURPOSE AND OBJECTIVES

1.4.1 Research aim/purpose

To determine the measles immunisation status and dropout rate among children aged between six months and 14 years residing in Hammanskraal, City of Tshwane.

1.4.2 Research objectives

- To identify the demographic characteristics and measles immunisation coverage among children aged between six months and 14 years in Hammanskraal, City of Tshwane.

- To determine the dropout rate of the measles immunisation programme for children aged between six months to 14 years in Hammanskraal, City of Tshwane.

- To assess factors associated with the knowledge of and attitude and perception towards the measles immunisation programme of the caregivers of children aged between six months and 14 years in Hammanskraal, City of Tshwane.

1.5 RESEARCH QUESTIONS

- What is the measles vaccine coverage and demographic characteristics among children aged between six months and 14 years in Hammanskraal, City of Tshwane?

- What is the dropout rate of the measles immunisation programme for children aged between six months and 14 years in Hammanskraal, City of Tshwane?

- What factors are associated with the knowledge of, attitude and perception towards measles of caregivers of children aged between six months and 14 years in Hammanskraal, City of Tshwane?

1.6 SIGNIFICANCE OF THE STUDY

The greatest ambition of public health research is to produce evidence-based care, thereby adding to the body of knowledge (Grove, Gray & Burns 2013:11). Some of the pitfalls that led to, or were related to the resurgence of the measles outbreak in

Gauteng in May 2017/June 2017 are highlighted in this study. It is envisaged that the results of this study will lead to the improvement of measles immunisation coverage and reduction in the dropout rate in the Tshwane Health District. Gaps were also found in the measles immunisation educational programme by highlighting the relation of measles to caregivers' knowledge, attitude and perceptions.

1.7 DEFINITIONS OF KEY CONCEPTS

1.7.1 General definitions

1.7.1.1 ***Immunisation*** is the process during which a person receives a vaccine to create immunity or resistance to an infectious disease (CDC 2018:1 "immunisation: the basics).

1.7.1.2 ***A vaccine*** is a product that stimulates a person's immune system to protect an individual against a specific disease (CDC 2018:1 "Immunization: the basics").

1.7.1.3 ***Dropout rate*** is the percentage of children who start their immunisation schedule, but do not finish that vaccine schedule. In this study, the researcher focused on the MCV1 and MCV2 dropout rate (World Health Statistics 2020:21).

1.7.2 Independent and dependent variables

In this study the variable were defined as follows:

- **Independent variable-** factors associated with measles immunization uptake.
- **Dependent variable-** outcome variables depending on factors associated with measles immunization uptake.

1.7.2.1 Independent variable

- ***Socio-economic status*** is the measure of one's combined economic and social status, including education, occupation and income (Baker 2014:1).

- ***Demographic characteristics*** are natural characteristics in individuals, including age and gender (Frey 2018:1 sv “demographics”).
- ***Caregivers’ knowledge, attitude and perception***

Caregivers’ knowledge, in the context of this study, refers to their level of awareness and familiarity with the measles disease and related factors about protecting their children against the disease.

Caregivers’ attitude refers to their negative or positive behaviour regarding complying with measles immunisation.

Caregivers’ perception refers to their thoughts, intention and actions towards measles immunisation.

1.7.2.1 Dependent variable

- ***Measles fully immunized*** refers to all children who were immunized for the 1st dose of the measles vaccine at six or nine months of age, respectively, and who have not turned 12 months yet, and those who received the 2nd dose at the age of 12 or 18 months, respectively, at the time of the study.
- ***Measles unimmunized*** refers to children who neither received the 1st nor 2nd dose of the measles vaccine at the time of the study, however are above the expected age of the recommended age in the measles immunisation schedule.

1.8 THEORETICAL FOUNDATION FOR THE STUDY

This study was guided by Andersen’s Behavioural Model (ABM) of health service use to assist in understanding the reason families use health care, including immunisation uptake. In this model, it is suggested that people’s use of health services is anticipated to either use the service or not, and factors which enable or impede the use of the service. An environmental factor such as the health care system, predisposing characteristics such as demographic characteristics (child’s age and gender), social structure such as a caregiver’s educational level and employment status, influence the health behaviour. Health beliefs such as health-

related knowledge, attitude and perception might also influence the need for and use of health services (Andersen 1995:1).

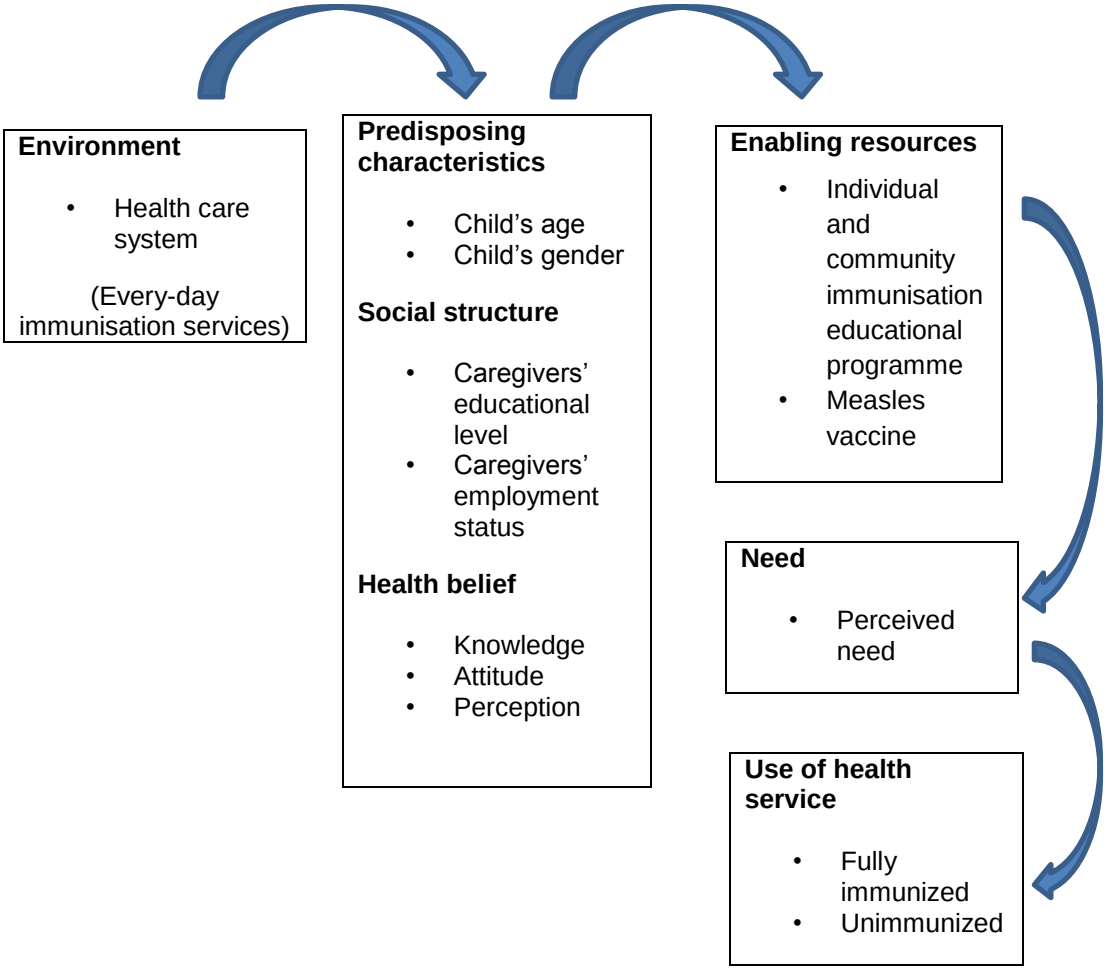


Figure 1.1: Independent and dependent variables mapped on theoretical framework: Andersen's Behavioural Model of health services use for immunisation status

Based on the ABM and literature reviewed, as shown in Figure 1.1 above, the researcher assumed that these factors predicted immunisation uptake.

1.9 METHODOLOGY

Quantitative research is an approach for testing objective theories by examining the relationship between variables (Creswell 2013:4). In this study, the researcher

followed the quantitative research approach by using the structured interviewer-administered questionnaire and observational checklist.

1.9.1 Research design

A research design is a procedural plan that is adopted by a researcher to address questions that determine the path to be taken when proposing the study design, how information will be collected from the participants, how the participants will be selected, how information that is collected will be analyzed, and how to communicate the findings (Kumar 2014:381). A descriptive study is a study in which a researcher does not intervene or manipulate the conditions surrounding the participants, but only observes and describes what is happening (Glasper & Rees 2016:65).

A cross-sectional study is a study design where data is collected at one point in time (Polit & Beck 2012:725). In this study, the researcher conducted a quantitative, cross-sectional study design among parents and caregivers of children who visited public health facilities for immunisation services between May 2018 and July 2018.

1.9.2 Population and setting

Hammanskraal is a small town in Northern Gauteng in Region 2 of the Tshwane District. According to Census 2011 (Statistics South Africa 2011:1), this area has a total population of 21 345 and approximately 32,5% of children younger than 14 years. A target population is the entire population a researcher is interested in and to which he or she would generalize the results of the study (Polit & Beck 2012:744). In this study, the target population included all parents or caregivers of children between the ages of six months and 14 years, who had visited an immunisation health facility for a routine immunisation appointment in Hammanskraal. The researcher identified and determined the measles immunisation status of this age group.

1.9.2.1 Inclusion criteria

An inclusion criterion is defined as the criteria that specify a population's characteristics (Polit & Beck 2012:274). The participants of this study were –

- all parents and guardians of children aged between six months and 14 years who had visited a health care facility for a routine immunisation appointment;
- health care facilities offering routine immunisation services; and
- all parents and guardians who were in possession of a Road-to-Health card.

1.9.2.2 Exclusion criteria

These are sampling criteria specifying the features or qualities that a population does not have (Polit & Beck 2012:727). The exclusion criteria for this study were –

- all parents and guardians of children aged between six months and 14 years who had visited a health care facility for any reasons other than immunisation services;
- all health care facilities not offering routine immunisation services; and
- all parents and guardians without a Road-to-Health card.

1.9.3 Sample and sampling

Sampling is a process of selecting participants who are representative of the entire population (Polit & Beck 2012:742). Simple random sampling is a basic sampling technique where a group of subjects (a sample) for the study is selected from a larger group (a population). Each individual was chosen entirely by chance and each member of the population had an equal chance of being included in the sample. In this study, the simple random sampling technique was conducted to parents or guardians of children aged between six months and 14 years who were in a possession of a Road-to-Health card between May 2018 and July 2018. Health facilities were also randomly selected mainly based on their provision of routine immunisation services.

The following assumptions were taken into consideration to determine the sample size (Raosoft Sample Size Calculator 2005):

- Total population of approximately 6 937 children aged between six months and 14 years;
- A confidence interval of 95%;
- A margin error of 5%; and
- Distribution of 50%

The study sample size was 377 parents or caregivers and 11 public health care facilities.

1.9.4 Data collection

Data collection is the gathering of information to address a research problem (Polit & Beck 2012:725). A structured questionnaire (refer Sections 1 of Appendix 1) was used to assess the knowledge of parents and caregivers regarding the importance of children's immunisation and the immunisation coverage of the health care facilities. Face-to-face interviews assisted in observing and understanding the participants' level of knowledge, understanding and social class (Polit & Beck 2012:265). In this study, face-to-face interviews were conducted using a structured questionnaire (refer to Section 1 of Appendix 1) among parents and caregivers in order to assess the level of enthusiasm about their children's immunisation status. A checklist (refer to Section 2 of Appendix 1) was used to assess children's immunisation status on their Road-to-Health cards. Furthermore, a pilot study was conducted to develop and test the adequacy of the research instruments.

1.9.5. Data management and analysis

After the cross-sectional survey data collection, and review for completion, data were saved safely on a laptop in a Microsoft Excel format, which was designated solely for this study. The laptop had a secret pin code known to the researcher and it was locked until ready to be given to the statistician for analysis. Analysis was performed using IBM Statistical Package for the Social Science (SPSS: Windows Operating System Version 23). Categorical variables were presented using frequency and

percentages, and continuous variables were shown as mean and standard deviations. Comparisons between groups were accomplished using chi-square and independent sample *t*-tests. The Spearman's correlation coefficient was also deployed to compare the relation between the variables.

1.9.6. Ethical considerations

1.9.6.1 Ethical clearance

The researcher received ethical clearance from the University of South Africa Research Ethics Committee: Department of Health Studies (Annexure A) and then applied for permission to conduct fieldwork at health facilities in the Tshwane District. A permission letter was submitted to the Tshwane District Research Committee and facility managers, as attached in Appendix 4.

1.9.6.2 Informed consent

Written consent was obtained before data collection, explaining sufficient information about the nature and effect of the research, consequences, and risks and benefits, which enabled the participants to make an informed choice about their participation in the study. Informed consent was adhered to throughout the duration of the study.

1.9.6.3 Respect for participants

The participants were informed of their right to refrain or withdraw from participating in the study at any time. Throughout the data collection, the researcher assessed whether the parents, guardians and health care workers wished to continue with the interviews and reassured them that they could decline their participation at any given time. The researcher kept all the documents in safe storage.

1.10 SCOPE AND LIMITATIONS

A limitation to the study was the respondents possibly giving false information as they feared their knowledge being judged. The participants were assured about confidentiality and privacy to ease their minds. The study was conducted in health care facilities where only health-conscious caregivers visited to seek care for their children. A community house-to-house survey would have been the best to detect measles immunisation coverage. Children without RTHB/C who came for other services than immunisation services were not included in the population of this study.

1.11 STRUCTURE OF THE DISSERTATION

The dissertation was divided into five chapters with supporting documents following the last chapter.

Chapter 1: Orientation of the study
Chapter 2: Literature review
Chapter 3: Research design and methods
Chapter 4: Data presentation, analysis and description of the research results
Chapter 5: Research findings, recommendations and concluding remarks

1.12 CONCLUSION

In this study, factors that led to low measles immunisation coverage and a high dropout rate in Hammanskraal were addressed. The results obtained from caregivers on their knowledge, attitude and perceptions were used to address the lack of health education on immunisation.

In this chapter, the background to the research problem was introduced with a brief epidemiology of the measles virus, significance of the problem, and the purpose and objectives of this study. The research design and methods were discussed and the structure of the dissertation was outlined. The following chapter focuses on the literature review.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

A literature review is a systematic analysis of the collected intellectual work that enlightens one about what is known and identifies areas where new information is needed about a topic. This is an ongoing process throughout a study, which assists a researcher in familiarising themselves with previous findings, including the research methodologies used in those studies (Efrom & Ravid 2019:2; Onwuegbuzie & Frels 2016:8).

The previous chapter presented the introduction of the study, the background to the study and the aims and objectives that impelled this study. A lack of research conducted in Hammanskraal concerning measles immunisation and dropout rates compelled the researcher to conduct the study. A literature review is influenced by methodological decisions on the research design, data collection methods and data analysis tools observed from other related studies (Efrom & Ravid 2019:257).

In this chapter, the literature review is debated in relation to the aims and objectives of the study. The study aimed at determining measles immunisation coverage and the dropout rate among children aged between six months and 14 years in Hammanskraal. Substantial literature in relation to the topic was explored in order to find gaps in the knowledge and factors that lead to measles outbreaks.

2.2 EXPANDED PROGRAMME OF IMMUNISATION

2.2.1 Global Expanded Programme of Immunisation

A lack of important resources such as finance, thermostable vaccines and suitable transportation to sustain immunisation services in countries was overcome by the launching of the Expanded Programme of Immunisation (EPI) in 1974. This was a

public health strategy to start a cost-effective stride of improving and protecting all children against six vaccine-preventable diseases globally (Sarkar, Sarker, Doulah & Bari 2015:1; WHO 2014:314). This programme significantly reduced the transmission of infectious diseases, morbidity and mortality due to tuberculosis, measles, tetanus, polio, diphtheria and whooping cough. Evidence that the programme is really effective is verified by the poliovirus, which is a highly infectious virus that causes irreversible paralysis, which has been stopped and targeted for global eradication in all countries except for Nigeria, Afghanistan and Pakistan. Progress towards global immunisation coverage also improved from 5% in 1974 to 30% in 1990 and a significant increase of 85% in 2018 (WHO 2014:314). However, there were 19.4 million unimmunized infants, as reported by the WHO and UNICEF, mostly residing in the African countries, including South Africa, hence the global goal target is still below 95% (Peck, Gacic-Dobo, Diallo & Wallace 2019:937).

2.2.2 African Region Challenges

A significant achievement in delivering effective vaccines and ensuring impartial immunisation of the population was recorded in the African Region Immunisation Programme. It was also observed by remarkable success in the introduction of new and underused vaccines, and the strengthening of surveillance for this vaccine's targeted disease on this continent (Anya, Okeibunor, Mihigo, Poy & Zawaira 2018:55). Surveillance for other vaccine-preventable diseases was successful, as witnessed by the reduction in incidence and progress towards achieving the elimination goal of Neisseria Meningitis Serotype A. Moreover, Nigeria's removal from the list of endemic countries for wild polioviruses resulted in Africa finally achieving their wild poliovirus eradication goal (Anya *et al* 2018:56; WHO 2019a:1).

However, EPI in Africa is challenged by inadequate funding, a lack of resources, poor immunisation data quality and vaccine stock-outs. As a result, immunisation coverage stagnated, as observed in sub-Saharan Africa due to gaps that need attention; hence, continuous research is being conducted in South Africa and Nigeria (Haddison, Machingaidze, Wiysonge, Hussey & Kagina 2018:2). The sub-Saharan

African immunisation coverage has been stagnant on 72% for the past few years, exposing residents to vaccine-preventable diseases and outbreaks (WHO 2019a:1).

2.2.3 EPI in South Africa

EPI was also adopted in South Africa with the aim of preventing mortality and morbidity from infectious childhood diseases and further eliminating these vaccine-preventable diseases in the future. In the programme, six diseases were covered initially, which improved throughout the years to vaccines being combined. Currently, South Africa provides 11 scheduled immunisations in its public health care facilities, including the recently introduced Human Papillomavirus (Davis 2019:27; Dlamini & Maja 2016:1). EPI goals in this country ensure that quality immunisation services are available equally to every child.

Significant achievements have been made in the programme, as observed by the polio elimination in 2006 and free polio certification issued on 17 September 2019 – one of the first countries on the African continent to introduce new vaccines successfully, which were financed by the government in full (Dlamini & Maja 2016:1; NICD 2019:1). Even with all the positive achievements mentioned above, the EPI-SA has not yet reached the immunisation coverage target of 90% (Burnett, Dlamini, Meyer, Motloung & Mphahlele 2019:1).

2.3 MEASLES EPIDEMIOLOGY

Measles is a highly communicable viral disease-causing disability and death among young children globally, especially in developing countries with inadequate health infrastructure (CDC 2016:1; Portnoy, Jit, Helleringer & Verguet 2018:170; WHO 2014:1; WHO 2017:207). The measles virus is a member of the Morbillivirus species. This virus has non-specific prodromal signs and can, therefore, infect an average of 12-18 people in a vulnerable population before developing a rash (Gastanaduy *et al* 2017:1). This is the reason why it hinders the effectiveness of early preventative measures (Fiebelkorn, Seward & Orenstein 2014:7; Holzmann, Hengel, Tenbusch & Doer 2016:202).

In most cases, a high temperature is the first sign after being exposed to the virus, followed by a runny nose, bloodshot eyes, a cough and small white spots inside the cheeks (CDC 2016:1; WHO 2017:209). A fine maculopapular rash erupts on the face and neck, and after three days, it moves to the hands and feet before spreading to the entire body (Vesikari & Van Damme 2017:70). Without treatment, measles-related deaths occur due to complications associated with the disease. Pneumonia, ear infections, severe diarrhoea, blindness and lifelong brain damage are common and mostly affect children younger than five years of age (CDC 2016:212; WHO 2017:209).

There is no specific antiviral treatment for the measles virus, but supportive care involving good nutrition, an adequate fluid intake and two doses of Vitamin A supplements. Treatment of measles complications and secondary infections is recommended. Prevention is by immunisation. The measles-containing vaccine is recommended, as per WHO policies, using two doses of vaccines to increase immunity and prevent outbreaks (WHO 2014:1).

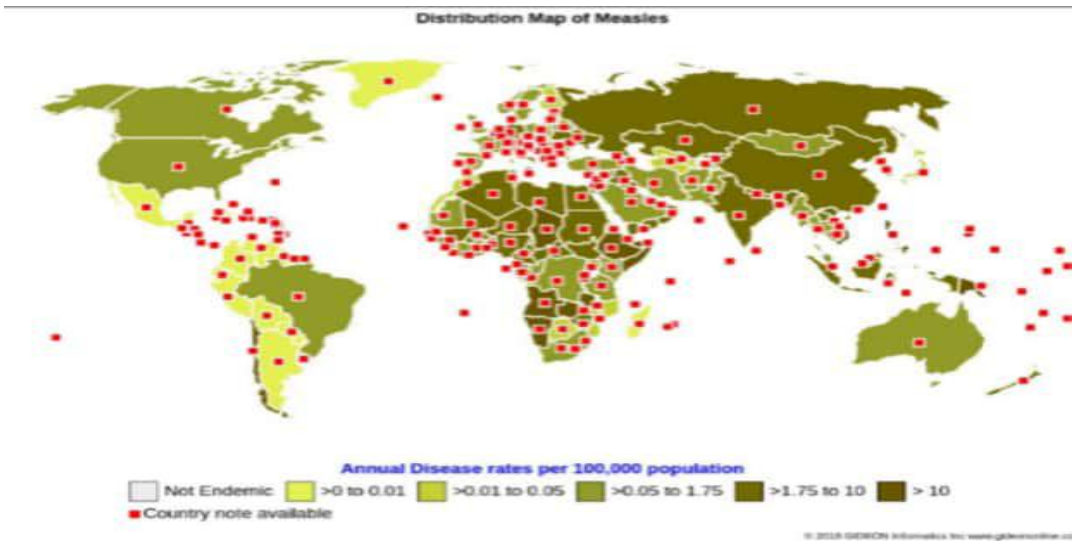
2.4 PATTERN OF MEASLES TRANSMISSION

The measles virus has a high reproduction rate (Ro) compared to all vaccine-preventable diseases. Transmission is from a simple cough or sneeze of an infected person's nose, mouth or throat (NDoH 2017:1). The measles virus can live up to two hours in airspace (Gastanaduy & Goodson 2017:1; Torner, Solano, Rius & Dominguez 2015:289), which means that it can spread quicker where there is an overcrowded population, overall measles vulnerability and in hotspot areas such as schools and hospitals (Plotkin, Orenstein, Offit & Edwards 2016:611).

2.4.1 Global measles spread

No country is immune to measles, as long as the virus still circulates worldwide. An introduction of the measles vaccine in 1963 brought a drastic reduction in measles spread globally, even though it still remained prevalent in developing countries,

including different parts of Asia and Africa, which is supported by Figure 2.1 below (Sartorius *et al* 2013:174). Countries in the Western Pacific and the Europe Region, such as the United States of America and South Korea, were declared measles eliminated in 2000 and 2006, respectively, but a new source of the measles virus has arisen there. Resurgence is due to unimmunized international travellers who are under or with an unknown immunisation status (Eom, Park, Kim, Yang, Kang & Kim 2018:1; Furuse & Oshitani 2017:1; Patel, Lee, Redd, Clemmons, McNall, Cohn & Gastanaduy 2019:1). Early detection in measles-eliminated countries is easily missed due to low incidence of measles cases, unanticipated measles and newly trained health care workers being less aware and inexperienced with measles. Moreover, imported cases are exposed to measles while abroad and return before the onset of the rash (Eom *et al* 2018:1).



(Gideon Informatics 2018)

Figure 2.1: Distribution maps of measles

2.4.2 Challenges of measles containment in Africa

Humanitarian crises due to natural disasters, armed conflicts and disease outbreaks are a norm in African countries. In these cases, regular health services, including routine immunisation services, are interrupted. During the Ebola virus outbreak in the African countries, there was a significant decline in access to immunisation services in facility-based immunisation due to the community's perception of contracting the

disease, the closure of other health care facilities and limited health staffing. This resulted in a general reduction in immunisation coverage, but mostly for measles as the after the Ebola outbreak, there was a sudden rise in reported measles cases (Wesseh, Najjemba, Edwards, Owiti, Tweya & Phat 2017:5). A displaced population usually stays in overcrowded refugee camps, which are risk factors for measles transmission (Nsubuga, Bulage, Ampeire, Matovu, Kasasa, Tanifum, Riolexus, & Zhu 2018:1). Building strong partnership with private and local communities, including community health education is very important in reducing measles transmission (Guha-Sapir, de Almeida, Scales, Ahmed & Mirza 2020:4)

2.4.3 Measles virus circulation in South Africa

Schools act as measles transmission hotspots in South Africa. A measles outbreak in an all-boys high school in Stellenbosch in 2017, where five cases were detected initially, resulted in 36 laboratory-confirmed cases epidemiologically being linked to the school (Azam 2018:52). In 2017, the measles outbreak in Gauteng was also linked to unimmunized primary school children (Hong, Makhathini, Mashele, Malfeld, Motsamai, Sikhosana, Manamela, Ntshoe, Motaze, Smit, Maseti, Dlamini, Kamupira, McCarthy & Suchard, 2018:69). Cross-border transmission observed by different genotypes which circulated endemically in West and Central Africa, attesting that the virus was imported, was detected with the 2010-2011 measles outbreak (Ntshoe *et al* 2013:1). In the Western Cape, imported measles cases were also detected on 11 April 2019 when four unimmunized siblings returned from a visit in Eastern Europe (Hong, Makhathini, Mashele, Smit, Malfeld, Motsamai, Tselana, Manamela, Motaze, Ntshoe, Kamupira, Khosa-Lesola, Mokoena, Buthelezi, Maseti, Maphoto & Suchard 2019:5).

2.5. HERD IMMUNITY

Herd immunity refers to the diminished risk of infection among vulnerable people in a population due to their presence and closeness to immunized people (Vesikari & Van Damme 2017:8). A threshold of 95% is effective to protect those who are immunocompromised (Naude 2015:12) and the entire community from the infectious

disease (Coughlin, Beck, Bankamp & Rota 2017:2). Herd immunity can be affected by the build-up of a vulnerable population in an area with low vaccine coverage, beliefs and religious objections to immunisation (Griffin 2018:89; Sartorius *et al* 2013:180). Herd immunity depends on a successful childhood immunisation programme (Williams, Peng-jun, O'halloran, Kim & Fielbekorn 2017:1). Unsurprisingly, children less than nine months old, who were not yet eligible for the measles vaccine, were affected the most in the 2011 measles outbreak in South Africa. High measles immunisation coverage is, therefore, needed to protect those too young to immunize against measles infection (Noh, Kim, Akram, Yoo, Cheon, Park, Kwon & Stekelenburg 2019:5).

2.6 MEASLES IMMUNISATION COVERAGE

The goal of childhood immunisation is not coverage, but long-term and early protection from unbearable diseases. Counting delayed immunisation with timely ones for calculating immunisation coverage results in an overestimation of coverage. This poses a great threat to the achievement of herd immunity and unnecessary risk of diseases (Hu *et al* 2018:5; Qazi, Malik, Raza, Saad, Zeeshan & Anwar 2018:3). Catch-up immunisation for children who defaulted to measles immunisation schedule also has a positive effect on immunisation coverage. In a study conducted in Tuscany, an increase of 5, 65% was reported after measles catch-up activities (Tavoschi, Quattrone, De Vita & Lopaico 2019:7 201).

2.6.1 Global measles immunisation coverage

Measles immunisation coverage, disease incidence and outbreaks are often considered good indicators of the immunisation programme performance of a country (Vesikari & Van Damme 2017:29). Global immunisation coverage for the 1st dose of the measles-containing vaccine was at 80% in 2007, increased to 84% in 2010 and then remained stagnant at 84% to 85% until 2017, whereas MCV2 increased from 33% to 67% in 2010 and 2017 respectively (Van Der Ende, Gacic-Dobo, Daillo, Conklin & Wallace 2018:1261). Opportunely, 118 countries achieved >90% of the national MCV1 coverage Global Vaccination Action Plan 2020 target.

This is due to countries in the African and Eastern Mediterranean region which had coverage below elimination levels in 2019, as compared to America where close monitoring of coverage and disease surveillance are priority components (Cutts, Ferrari, Krause, Tatem & Mosser 2021:6). Other WHO regions reached at least a target of 80% of MCV1 and 70% for MCV2 coverage. Unfortunately, the African region had the lowest MCV coverage ranges in 2017 (Van der Ende *et al* 2018:1262).

2.6.2 African region progress

The African Region has implemented appropriate strategies to target measles elimination in 2020. Out of the 47 countries in this region, only 14 maintained the MCV 1 coverage of 90% and more, and only 23 countries introduced MCV2 in their routine immunisation programme in 2015. The main challenges included funding and surveillance data. Inadequate funding resulted in non-implementation and postponement of critical activities such as introducing new vaccines. African Region MCV1 was at 70% in 2017, while MCV2 was at 25% – the lowest of all the regions (Van Der Ende *et al* 2018:1 262). Progress towards the regional measles target is also hampered by countries not submitting their district coverage data and untrustworthy data (WHO 2015:9).

2.6.3 South African obscure measles coverage

South Africa also adopted the Expanded Programme of Immunisation in 1975 using a single-dose measles-containing vaccine. In 1995, a double-dose strategy was adopted. The goals of EPI-SA were to ensure that quality immunisation services were equally available to every child and to attain less than one case per million of the total population for the measles elimination target (Davis 2019:27; Hong *et al* 2018:75). Two-dose measles immunisation coverage of 95%, as recommended by the WHO, is required nationally and 80% at the district level, as high population immunity is a measure to monitor progress towards measles elimination (Shibeshi *et al* 2014:1 806). Nationally, the first dose of measles-containing vaccine coverage was 86%, while MCV2 reached 69% in 2018 (World Health Statistics 2020:7).

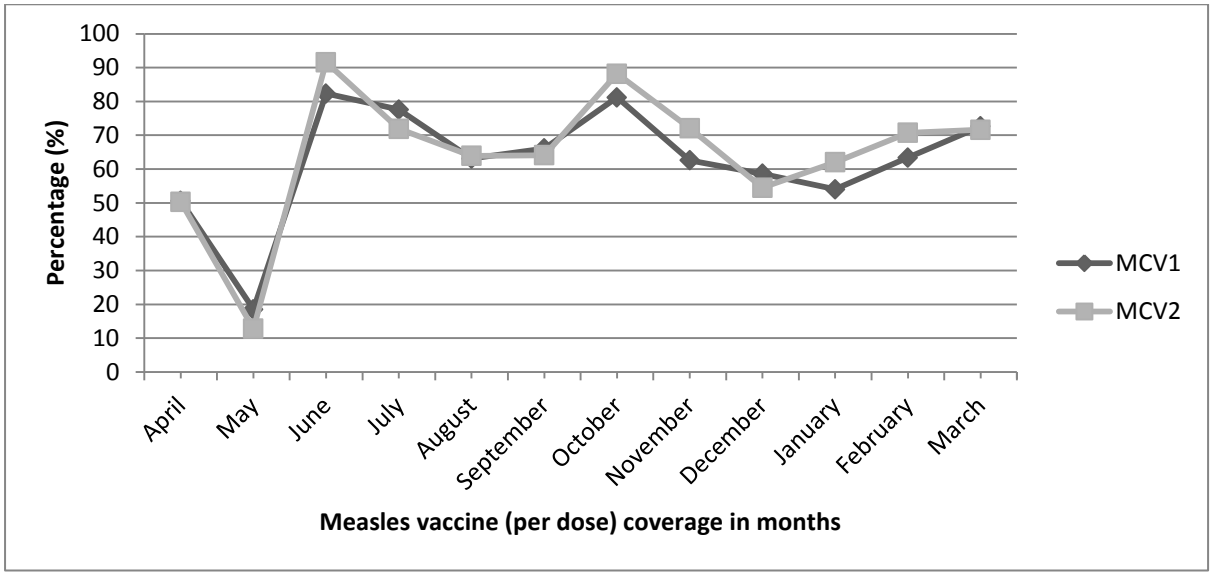
In South Africa, on a national level, the measles immunisation coverage is high with the challenge being at the provincial and district levels (WHO 2015:70). This is validated by the measles outbreaks for the periods 2003-2005 and 2009-2011 when some districts had low immunisation coverage and the risk of infection increased in high-density metropolitan areas (Ntshoe *et al* 2013:6; Sartorius *et al* 2013:180). The opposite has been reported by the World Bank, that South Africa has been below 90% with its measles immunisation target since 1990. The declining measles immunisation coverage was reported at 60% in 2017, exposing vulnerable children more to measles outbreaks (WHO 2019a:1; World Bank 2018:1). Unfortunately, South Africa's measles incidence rate was at 3,7 cases per million in 2017, significantly above the 2020 elimination targets of the WHO, of one case per million (South African Health Review 2018:92; Hong *et al* 2018:75).

2.6.4 Gauteng Province endeavour

The City of Tshwane, which falls under Gauteng, also had its target for measles immunisation coverage. The aim was to achieve 85%-95% of MCV2 coverage and to reduce the dropout rate from 3,5% to 2% by 2019/2020. However, the district had MCV2 coverage of 105,7% in 2016/2017 and 74,5% in 2018. Even though the dropout rate was below the recommended target of 10%, the dropout rate was uncertain as there were negative dropout rate recordings. Poor performance of the district might be due to an increased in the population of children under one year of age (Department of Health Annual Report: Gauteng 2018:42).

2.6.5 Tshwane Sub-district 2 poor performance

Full measles immunisation coverage is considered as two doses of the measles vaccine, expected to have been administered to a child by the age of 12 months since the change of the South African measles routine schedule in 2015 (NDOH 2015:1).



(Tshwane DHIS 2018)

Figure 2.2: Measles immunisation (1st, 2nd) coverage Tshwane Sub-district 2 for April 2017/March 2018

Figure 2.2 above shows the measles immunisation coverage according to doses administered in Tshwane Sub-district 2. The results showed inequalities in measles immunisation coverage throughout the year. Furthermore, the national measles immunisation coverage target goal of 95% was not achieved consistently throughout the year. Moreover, a sharp decrease pattern in inequalities of measles immunisation coverage was revealed.

From the survey of records, the dropout rate was calculated from the difference between MCV1 and MCV2, which was found to be between 5,7% in some health care facilities and as low as -9.3% in the poor-performing Tshwane Sub-district 2, as shown in Figure 2.2.

2.7 MEASLES DROPOUT RATE

The dropout rate refers to the percentage of children who start their immunisation schedule for a specific vaccine at a health care facility compared to the percentage who complete that specific vaccine recommended schedule. If a caregiver takes a child to another facility for a second or third dose of the vaccine, the system will consider the child unimmunized at the facility where they received the first dose of

that vaccine (Haji, Lowther, Ngan'ga, Gura, Tabu, Sandhu & Arvelo 2016:1). To minimize immunisation dropouts, educating and counseling the caregiver about the benefits of vaccines, vaccine safety, follow-up dates, adverse effects following immunisation and its management, is a goal to increasing immunisation coverage (Feldstein, Mariat, Gacic-Dobo, Diallo, Couklin & Wallace 2016:1254; Kurane & Swathi 2018:1).

Measures were taken to reduce the dropout rate using sticker reminders and short message services (SMSes). Sticker reminders placed intentionally in a home with suggested return dates for immunisation and SMSes via cellular phones have successfully reduced dropouts in Ethiopia and Zimbabwe (Haji *et al* 2016:1). South Africa has also been introducing MomConnect since 2014 – a national pregnancy register where, after a health care provider confirms a pregnancy, the expectant mother registers her cellular phone number and messages will be received with information to support the maternal health user. It provides valuable services from five weeks of pregnancy until the child is one year old in order to improve the health of the expectant mother and the baby once it has been born (NDOH 2016:1). MomConnect represents a powerful platform through the use of digital health technologies for integrated health service and real-time data collection to improve patient care (Barron, Peter, LeFevre, Sebidi, Bekker, Allen, Parsons, Benjamin & Pillay 2018:4). The Tshwane health district also has community health workers, known as ward-based outreach teams, to liaise with the community in order to improve access to health by tracing individuals who have defaulted treatment and linking them back to health care facilities (Naidoo, Railton, Jobson, Matlakala, Marincowitz & Peters 2018:2).

2.8 FACTORS ASOCIATED WITH MEASLES IMMUNISATION COVERAGE

2.8.1 Socio-economic status

Socio-economic status is a measure of one's combined economic and social status, including education, occupation and income (Baker 2014:1). It is an important determinant of standard of living and health status as it influences the incidence and

prevalence of various health conditions (Srirangam, Kumar, Mukerji & Gupta 2017:1). South Africa is challenged by high poverty, high inequality and high joblessness, especially in females, as reported that 29% of the population is unemployed (South African Health Review 2018:152; Statssa 2019:1).

Lower socio-economic status, especially in rural areas in South Africa, are linked to incomplete immunisation (Stellenberg & Abrahams 2015:2; Toure, Saadatian-Elahi, Floret,Lina & Vanhems 2014:1 759; Zewdie, Letebo & Mkonnen 2016:1). Mothers' education and immunisation coverage have a significant association, because the education status of the mother is directly related to fertility pattern and child health indicators (Kurane & Swathi 2018:1) However, in one study which was conducted in South Africa, the findings denied that maternal education, maternal employment, household poverty and staying in a rural area has a significant association in the health-seeking behaviour and attitude towards childhood immunisation (Ndwandwe *et al* 2020:4).

2.8.2 Knowledge about immunisation

Knowledgeable patients can actively make decisions concerning their health (Dube, Laberge, Guay, Bramadat, Roy & Bettinger 2013:1 765). A lack of awareness, poor understanding of the reasons for immunisations, when and where one accesses and conveniently goes for immunisation results in a lack of immunisation (Dube *et al* 2013:1 768; Tabana, Dudley, Knight, Cameron, Mahomed, Goliath, Eggers & Wiysonge 2016:9). Parents sometimes even lack the knowledge of which vaccine must be administered to their children (Facciola, Vissali, Spataro & Di Pietro 2019:17; Maseti 2015:98).

2.8.3 Influence of Health Care Professionals

Patient-health care provider's communication is the foundation of sustaining confidence in immunisation. Attitude and knowledge towards a vaccine from the health care providers have an influence on their patients. Most caregivers accepted

immunisation as it was recommended by their trusted health care provider (Dube *et al* 2013:1 767). A change in health care professional and language barrier attribute to a lack of understanding of the importance of immunisation. In one study, 79.5% of the physicians recommended that parents have their children vaccinated (Facciola *et al* 2019:16). Patient-centred care addresses individuals' needs and preferences, resulting in better clinical outcomes (Fernandez, Rossouw, Marcus, Reinbrech-Schutte, Smit, Kinkel, Memon & Hugo 2014:6).

2.8.4 Vaccine stock-out

Vaccine shortages are a great concern and an obstruction to successful measles elimination activities as it prevents certain children from receiving the benefits of being fully immunized (Feldstein *et al* 2016:1254, WHO 2016:43). Stop stock-out projects were formed in 2013 as a consortium for monitoring and reporting on the availability of essential medicines, childhood vaccines and chronic medicines in South Africa. South Africa experienced a strike in the North West in May 2018 where gates to five clinics were closed due to the insufficient supply of medication and vaccines, resulting in stock-out (Stop Stockouts Project 2018:1). Moreover, a study of 31 clinics in Tshwane, which were conducted in April 2015, showed that most clinics had stock-outs for two weeks to a month due to poor stock management, unreliable deliveries, a lack of pharmacy assistants and limited fridge capacity where 11 items were out of stock in 9 (29%) of 31 clinics. Basically, all participating clinics had vaccines stock-out over different periods in the past 12 months, which included measles vaccines, measles diluent and syringes (Bateman 2016:319). Improved and effective vaccine management can increase immunisation uptake in order to establish a sustainable national immunisation programme and to eliminate preventable diseases and deaths among children (Feldstein *et al* 2016:1 254; WHO 2015:200).

2.8.5 Vaccine Hesitancy

Vaccine-hesitant individuals delay acceptance or may refuse some vaccines and agree to others, despite the availability of immunisation services (Dube *et al* 2013:1

763; Miko, Costache, Colossi, Neculicioiu & Colossi 2019:2). This is a threat to global health as it can result in outbreaks by vaccine-preventable diseases because of low immunisation intake due to indecision and mistrust by the population. Vaccine misinformation and myths can be corrected by health care education from a person who is highly regarded or trusted as the main reasons for hesitancy are knowledge and awareness, perception of risks and benefits, including socio-economic status, culture and religion (Facciola *et al* 2019:16; WHO 2019b:47).

2.8.6 Missed opportunities for immunisation

Missed opportunities for immunisation happen when a person with no valid contraindication visits a health care service facility and does not receive the recommended vaccines to which they are entitled. Progress in achieving high immunisation coverage and global immunisation goals is, therefore, limited. An integrated health care service can improve the health of a community if all services and disease screening can be offered, irrespective of the reason for visiting the health facility. This can be cost-effective to patients or caregivers and can help to reduce more visits to health care facilities (WHO 2016:52; Reaching Every District 2017:55). Every child should be immunized, irrespective of unavailable documentation (WHO 2016:54).

Vaccine stock-outs is the major foundation of missed opportunity to vaccinate, followed by caregivers' poor knowledge of immunisation processes and cultural beliefs that can significantly deteriorate immunisation coverage (Jacob & Coetzee 2015:917; Ramraj & Chirinda 2016:155).

2.8.7 School Health Policy

South Africa adopted the School-Based Health Policy in order to coordinate schools' health services and reduce absenteeism among learners. The Integrated School Health Policy was developed by the Department of Health and Department of Basic Education in 2012 as the coordinated health care service delivery programme to prevent, promote and rehabilitate the ideal health of learners (Dibakwane & Peu

2018:1). The National Education Policy Act, 1996 (Act No. 27 of 1996) of the admission policy for learners in ordinary public schools requires that a learner present proof of a full immunisation record before being admitted to school. Supported by the ISHP (2012), which also emphasises documented evidence of immunisation to children before being admitted to school (Integrated School Health Policy 2012:32). In section 29(1)(a) of the Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996), it is stated that education is a basic human right and anything that will infringe a child's right to education needs to be avoided (*Government Gazette* 1998:A-9).

There are no consequences stated by these regulations and policies for failure to produce proof of immunisation as it is not mandatory to vaccinate in South Africa (NICD 2017b:1; Mahery & Slemming 2019:77). Instead, the principal must admit the child and encourage the caregiver to immunize the child (Department of Education 2019:1). Hence, children are still admitted to attend school, irrespective of their immunisation status, and South Africa still encounters measles outbreaks in school children previously unimmunized against measles (NICD 2017b:1). According to the ISHP (2012), the school health team should be led by a professional nurse, but in the City of Tshwane, 65% of the schools did not have any integrated school health nurses in their school health services (Rasesemola, Matshoge & Ramukumba 2019:5). That means comprehensive health care such as screening of immunisation status, illnesses and on-site treatment is inaccessible and unavailable for those learners (Dibakwane & Peu 2018:6). Measles immunity among the school-going age can be achieved by checking immunisation cards and offering immunisation to those unimmunized (Funk, Knapp, Lebo & Strebel 2017:9). Unfortunately, strategies targeting unimmunized children before enrolling in schools and current measles immunisation policies are not yet adequate to achieve and maintain elimination of the disease and enhance the fulfilment of WHO targets (Trentini, Poletti & Merler 2019:1).

2.8.8 Supplementary Immunisation Activities

Supplementary Immunisation Activities (SIAs) are mass campaigns recommended by the WHO, to directly supplement routine immunisation to targeted children, regardless of their immunisation status. The main aim is ensuring measles herd immunity of more than 95%, hence immunisation is heeding the call to all children less than 15 years of age, even in the absence of an outbreak (NICD 2017a:1; Portnoy *et al* 2018:171; WHO 2015:308). However, due to funding gaps and uncertain financial guarantees, most countries limit the target age groups covered by SIAs, despite a wider age range being indicated (Kaiser, Shibeshi, Chakauya, Dzeka, Masresha, Daniel & Shivute 2015:314; WHO 2015:296-297).

South Africa carried out a nationwide periodic supplementary immunisation campaign in 2010 and 2017, respectively, for children from six months to 14 years (Bernhardt, Cameroon, Willems, Boule & Coetzee 2013:1; Ntshoe *et al* 2013:4). The recommended SIA routine by WHO in countries with an increased measles outbreak is three to four years. Hence, this gap of seven years exposed a pool of vulnerable children eligible for immunisation to measles outbreaks (WHO 2016:6).

Though SIAs are known to increase vaccine coverage in the low- and middle-income continents, they may unsettle routine immunisation services. A study conducted in Bangladesh, Senegal, Too, Gambia and Cote d'Ivoire between 1996 and 2013 supports that SIA exposure reduces the opportunity to receive routine vaccines in all countries included in their study (Chakrabarti, Grepin & Helleringer 2019:11).

2.9 ROAD-TO-HEALTH BOOKLET RECORD KEEPING

The Road-to-Health booklet has been an initiative of the South African Department of Health (NDOH) since 2011, to record and monitor a child's immunisation history and status up to the age of 12 and to monitor growth and danger signs. It also reminds parents about return visit dates and it is beneficial when coverage surveys are conducted (NDOH 2016:1; PAHO 2017:52). A change of an immunisation schedule requires resources such as communication, training of health care workers

and creating new recording materials before implementation (WHO 2015:303). It took two years for South Africa to adapt to the updated Expanded Programme on Immunisation schedule. The NDOH planned to launch the revised RTHB (refer to Table 2.1) in late 2017 or early 2018. Health care workers had to state by hand next to measles vaccine if the vaccine was for six months or 12 months (NDOH 2016:1).

Table 2.1: EPI-SA-Revised immunisation schedule from December 2015

Age of child	Vaccines needed
At birth	BCG
	OPV (0)
6 weeks	OPV (1)
	RV (1)
	DTaP-IPV-Hib-HBV (1)[o]
	PCV (1)
10 weeks	DTaP-IPV-Hib-HBV (2)
14 weeks	RV (2)
	DTaP-IPV-Hib-HBV (3)
	PCV (2)
6 months	Measles vaccine (1)
9 months	PCV (3)
12 months	Measles vaccine (2)
18 months	DTaP-IPV-Hib-HBV (4)
6 years	Td vaccine[p]
12 years	Td vaccine

(NICD 2016)

Even though all parents receive the RTHB after the birth of a child, the South African Demographic and Health Survey reports that only 66% of caregivers of children ages 12-23 months have an RTHB (South African Early Childhood Review 2017:15). It is recommended by NDOH for caregivers to bring the booklet along when they visit any health care facility (NDOH 2016:1). Every contact with a child is an opportunity to check if he/she is up to date with their immunisation; hence, it is a provision to record administered immunisations on the RTHC to allow tracking of the child's immunisation status (Aung & Dlamini 2018:99; WHO 2017:222). Record keeping of the MCV1 and MCV2 on a child's immunisation card/booklet and in a clinic immunisation register is recommended – even those delivered through mass campaigns (NICD 2017b:1 WHO 2015:9).

2.10 CONCLUSION

In this chapter, the context of the Expanded Programme of Immunisation, including measles immunisation coverage, was discussed. Factors affecting measles immunity were explored in finding solutions to recurrent measles outbreaks in the City of Tshwane and South Africa. Possible strategies to increase measles immunisation coverage and reducing the measles dropout rate were documented in this chapter.

CHAPTER 3

RESEARCH DESIGN AND METHODS

3.1 INTRODUCTION

To increase people's knowledge, research must be conducted as it helps us understand the social world, and promotes agreed-upon practices that help us avoid the limitations and pitfalls of other ways of knowing an idea (Leavy 2017:4). This study was, therefore, conducted to increase knowledge by determining demographic characteristics, measles immunisation status and dropout rate among children aged six months to 14 years residing in Hammanskraal, City of Tshwane.

In this chapter, the research methodology of the study is presented, focusing on the research design, research setting, population, sample and sampling technique, data collection method, data management and analysis, and ethical considerations.

3.2 RESEARCH DESIGN

A research design is a plan that provides the construction to collect and analyse data in order to answer research questions and test study hypotheses (Antonius 2013:39; Aparasu & Bentley 2014:33). It ensures that the study assents to the research ethics and methods, and that the aims and objectives are appreciated in practice (Antonius 2013:39). A quantitative descriptive cross-sectional design using personal interviews directed by structured questionnaire and an observational checklist (refer to Appendix 1), were used to generate data for this study.

3.2.1 Quantitative research

A quantitative design is a predetermined framework to ensure validity and reliability of the data and its classification (Kumar 2019:170). Quantitative research methods and designs establish the body of knowledge needed for evidence-based practice as this design focuses on counting incidence of a certain feature, then summarizing it

by breaking the larger part into a smaller part so that the smaller parts can be examined in order to generalise the findings about the larger part (Grove *et al* 2013:3-34; Rasinger 2013:1). The deductive approach involves developing a theory that is tested; hence, this study began with Social Theory, then tested a hypothesis with data collection to discover evidence to support the theory (Babbie, Halley, Wagner & Zaino 2013:11). A quantitative positivist model was used as the aim of the study was to objectively find the truth about the measles immunisation coverage and dropout rate in Hammanskraal (Ling & Ling 2016:28).

3.2.2 Descriptive research

Descriptive research depicts the characteristics of an individual, group or situation without affecting their normal immunisation. A descriptive strategy builds up a logical and empirical foundation that can be used for future research (Rosnow & Rosenthal 2013:13). The manipulation of the variable is minimal as the independent variable has occurred naturally. Non-experimental studies are minimally or partially controlled as the subjects are observed as they exist in their natural setting, which are uncontrolled, real-life settings (LoBiondo-Wood & Haber 2018:8). This study was descriptive as the researcher thoroughly observed participants at a health care facility, collected data without affecting their normal immunisation and presented the data to give a clear representation of the situation.

3.2.3 Cross-sectional aspect

A cross-sectional research design is a collection of quantitative data at a single point in time to determine the correlation between the variables (Bryman 2016:53). Participants in a cross-sectional study may be recruited over a longer period of time, but data are collected at a single point in time; hence, this study method is considered quick, easy and cost-effective to perform. Prevalence is defined as the percentage of the population that has the immunisation or the disease at a particular time. Mostly, primary data are used to collect such information and the results may inform a hypothesis of more complex investigations. Hence, this study is also suitable for estimating the prevalence and to study relations between health statuses

(Bruce, Pope & Stanistret 2018:1; Flick 2018:97). It is also useful in identifying association that can later be studied in detail to identify the causes of low measles immunisation coverage and high dropout rates (Sahu & Singh 2016: 36).

3.2.4 Data collection instruments

A data collection instrument is a tool used to gather data (Canals 2017:399). The researcher used two types of questionnaires, as stated below.

3.2.4.1 Personal interview using a structured questionnaire

Structured questionnaires are verbal interactions with the participants, which is controlled by the researcher to obtain essential data for a study. This is a reliable and valuable research method as the respondents are asked the same questions in the same way and are limited to respond in answers designed by the researcher and suitable for collecting a wide range of information from the large number of individuals. Personal interviews were preferred because of their high response rate. Moreover, they stimulate the trust and cooperation for the completion of the answers because a researcher has a chance to repeat questions when the participants do not understand (Rosnow & Rosenthal 2013:99; Gray, Grove & Burns 2013:422).

3.2.4.2 Observational checklist

An observational checklist is using a designed inspection to measure study variables. It is more subjective, but a focused way of obtaining evidence of practice as other behaviours' other than that on checklist are ignored. It is a quicker method of data collection, because an immunisation is observed and then tallied on a specified category (Gray *et al* 2013:421-422). RTHB/C were observed to depict the measles immunisation status of children.

3.3 RESEARCH METHOD

3.3.1 Population and Sampling

Sampling is defined as a selection of a group with which the researcher is interested with which to conduct a study. Random sampling assures every component in the population an equal chance of being selected (Leavy 2017:76-110).

Simple random sampling emphasises that each element has an equal chance of being selected to participate in a study (Singh 2013:30). This sampling method is easy to use, minimise sampling error and accurate in taking out a sample from a larger population. All 11 health care facilities offering immunisation services in Hammanskraal had an equal chance to be chosen; however, only nine gave the researcher authority to use their facility in her study. The sampling frame was used after selecting the willing eligible caregivers, where every second parent or caregiver was chosen as a participant at that point in time (Grove *et al* 2013:205).

Sample is demonstrative of the accessible population and accessible population is representative of the target population. Accessible population are individuals who meet the designated criteria and are accessible for a study (Polit & Beck 2012:274). Target population is the entire group of individuals about which the researcher wants to generalise. Accessible population in this study comprised of all parents or caregivers of children aged between six months and 14 years in Hammanskraal, who visited either one of the nine used health facilities during collection of data, who came for immunisation services and meeting the eligible criteria(Polit & Beck 2012:274). Larger sample was used to enhance statistical conclusion validity (Polit & Beck 2012:291).

For margin of error to be reasonable, the researcher chose a sample that is larger, to make conclusions about the whole population with the intention of minimising the risk of gathering data that may not support the hypotheses (Antonius 2013:183; Polit & Beck 2012:285).

3.3.2 Eligibility Criteria

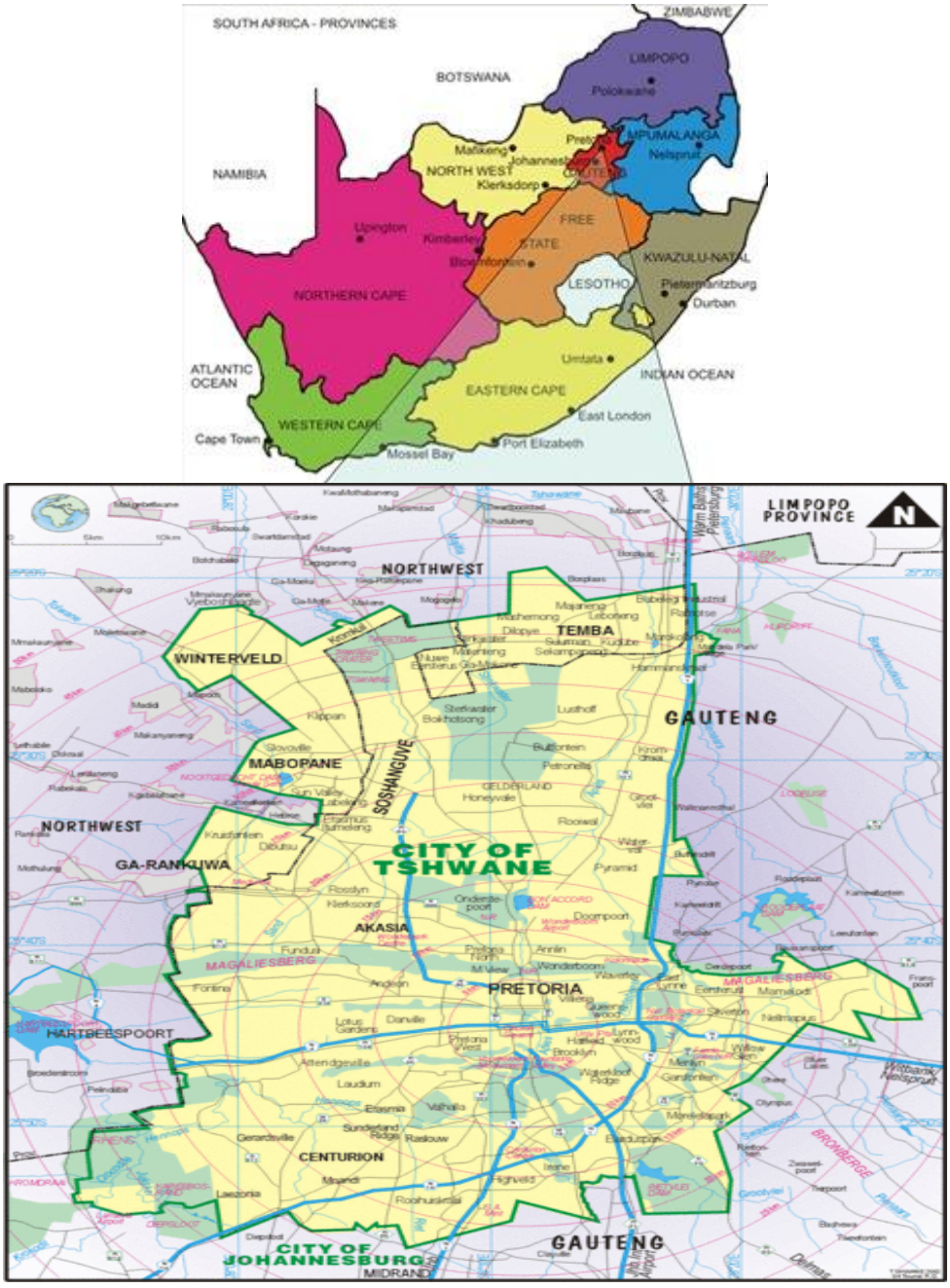
Eligibility criteria are the specific standards that identify suitable participants to be included in the study. Inclusion criteria are contained in a list of requirements that determine which participants will qualify to participate in the study, whereas exclusion criteria determine individuals who should not be enrolled in the study in order to focus on a suitable population that will best answer the research questions. The selection of participants was appropriately matched with the goal of the study to attain measles immunisation coverage and dropout rate in Hammanskraal. To ensure the truthfulness of the research results, the balance between inclusion and exclusion criteria had to be distinguished (McElroy & Ladner 2014:134). For the purpose of this study, the inclusion and exclusion criteria are tabled below.

TABLE 3.1: INCLUSION AND EXCLUSION CRITERIA

Inclusion Criteria	Exclusion Criteria
Parent or caregiver of a child(ren) between the ages of six months to 14 years seeking immunisation services	Parents who brought their children to health facility for other services other than immunisation
Have a road to health card in their possession at that time	Caregivers without RTHB/C
Health care facility at Region 2, Hammanskraal, offering immunisation service during the duration of data collection	Refusal to participate in the study
Willingness to participate in the study	

3.3.3 Research setting

Research setting is a site where a study is conducted (Grove *et al* 2013:373). Hammanskraal is a location situated about 50 km north of Pretoria, on the northern periphery of the City of Tshwane Municipality in Gauteng, South Africa. It is on the Gauteng borderline to Limpopo and the North West, as shown in Figure 1.1. Though urban in character, the majority are rural areas under chiefs. These areas have socio-economic challenges such as poverty, unemployment and substance abuse (Mathibela & Skhosana 2019:88; Ndwambi & Govender 2015:130).



(mappery.com)

Figure 3.1: City of Tshwane map

Multisite research is explained as the use of multiple areas or institutions as the areas to conduct a study. They are considered as appropriate in recruiting large numbers and diverse participants from different geographical areas. It means they are good in increasing generalisation (Ferguson & Master 2016:3). Multisite research, using a natural setting to conduct this study, was appropriate as a large sample of participants were interviewed at a health care facility, no manipulation or

any effort was made to change the environment (Groove *et al* 2013:373). This study was conducted in nine of 11 eligible public health facilities, which are situated in Hammanskraal in Region 2 of the City of Tshwane district. These public health facilities offer immunisation services daily from 08:00 to 16:00.

3.4 DATA COLLECTION

3.4.1 Pilot testing

Pilot testing is defined as the smaller scale of a proposed study, which is conducted to point out any problem with the methods of obtaining, organising or analysing data (Grove *et al* 2013:703). Piloting was conducted with five participants who met the eligible criteria from one health care facility. However, the result did not form part of the actual study. Feedback from this pilot testing assisted to assess face and content validity, identify problems and refine the questions in order to improve their clarity and the completeness of the given responses and, in return, the research assistant was also evaluated. Face validity assesses whether an instrument gives the appearance of measuring target construct whereas. Content validity refers to the extent to which measurement methods are fairly representative of the major elements relevant to the construct being measured (Gray, Grove & Burns 2016:371).The measurements tools were also given to the supervisor to enhance face and content validity.

This also helped in the estimation of the time and costs needed to complete the study and provided an opportunity for testing the reliability and validity of the instrument (Grove *et al* 2013:424). Briefly, in this pilot study, the researcher was informed and improved to enhance the readiness to conduct the actual study.

3.4.2 Description of data collection

Data collection is the well-planned gathering of relevant information for the research purposes or questions of a study. Planning of data collection resulted in predicting the problems and rectifying them before the actual research (Grove *et al* 2013:45).

The researcher used two sets of sections divided into different parts for questionnaires (see Appendix 1), which were designed for all parents or caregivers of children between the ages of six months to 14 years and the Road-to-Health booklet or card checklist. In Section 1, personalized interviews were used to question participants to provide information to the researcher. Questions were repeated if the participant did not understand (Grove *et al* 2013:422).

The first part consisted of four demographics questions about the parents or the caregivers' educational level, employment status and the child's age and gender brought for an immunisation service. Part 2 of Section 1 of the research questionnaire: Focused on knowledge, attitude and perception about measles immunisation programme. Participants had to answer using yes or no response about knowledge of measles disease and vaccine schedule, importance of immunizing a child, if they know the School Health Programme Policy, their attitude towards mass campaigns and the perception about their children's measles immunisation status

Section 2: is a Road to Health Booklet/Card checklist where the interviewer observes the Road to Health Card Booklet to screen for the immunisation status of the child.

3.4.3 Data collection instrument compilation

Information desired for data collection tools was derived from the aims and objectives of the study. The researcher compiled all the data collection tools with the assistance of the recent guideline for measles immunisation in the South African Department of Health (NDOH 2015:1) and the common questions about measles (WHO 2015:1). With the assistance of the supervisor, two questions were modified to meet the participants' level of understanding. The wording is in plain English, structured personal questionnaire, open-ended and observational checklist were chosen as a large sample size was required. The observational checklist was developed by the use of old(where measles was administered at 9 and 18 months) and a current Road to Health Booklet/Card to inspect if and when was the child immunized for each measles dose.

3.4.4 Data collection process

Data were collected for 10 weeks (14 May 2018 to 31 July 2018). The target was 377 participants; however, four more willing participants volunteered, increasing the sample size to 381. These participants were parents or caregivers of children between the ages of six months and 14 years, and nine public health care facilities offering an immunisation service on the day of the data collection. The researcher and the research assistant were responsible for collecting the data. A five-day training intervention was offered to the research assistant a week before the collection of data and her performance was evaluated during the pilot study.

3.4.4.1 Recruitment of participants

All people attending the immunisation service, sitting in the waiting area of the health care facility, were approached at that point in time by the researcher who verbally informed them about the study. The recruitment of participants was a day-to-day process. Those who were willing to participate were taken to a separate area. Every second person of the willing participants was chosen and given an information leaflet (Appendix 2), together with a consent form (Appendix 3) to read further, and then to complete it. A separate area was used to interview each participant, directed by the structured tabulated questionnaire (Appendix 1). The questionnaires were organized to start with demographics, which are less personal, before probing into the knowledge of measles. Then the researcher and research assistant requested the Road-to-Health card/booklet to screen for the measles immunisation status of the child. The data obtained from the RTHB/C was validated by questioning the participants if the card was used for all visits to the health care facility. This assisted in identifying any missed recording.

3.4.5 Data management

Data preparation includes the researcher inspecting all questionnaires to ensure that they have been completed fully and that no mistakes were made daily before leaving

the attended facility. Each questionnaire was given a unique identity for error tracking purposes. The questionnaires were captured onto Excel, verified as entries and saved on an encrypted flash drive for safety reasons before sending them to the supervisor for further data cleaning, then the statistician for data transformation, development and documenting a database structure that integrates various measures (Singh 2013: 299).

3.4.6 Data coding

Data coding is the process of changing a respondent's answers into numerical symbols in order to capture them on a computer for statistical analysis (Leavy 2017:256). Each category is mutually exhaustive and can only fit in one category (Grove *et al* 2013:518). The variables were each given a value according to their sequence in questionnaire form where all the first variables were given value 1, 2 and so forth. The variables were further tested for homogeneity of variance during data coding as shown in Table 3.2 below. The alternate hypothesis for all the variables was statistically significant with assumption of the hypothetical mean to be equal to 1.

Table 3.2 Test for homogeneity of variance (n=381)

Variables	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
Age	381	1.703412	.0319169	.6229927	1.640656	1.766168
Gender	381	1.451444	.0255282	.498291	1.401249	1.501638
Educational level	381	1.687664	.0312992	.6109355	1.626123	1.749205
Employment status	381	1.412073	.0435273	.8496198	1.326489	1.497658
Home language	381	4.590551	.1532474	2.991271	4.289232	4.89187
Biological parent	381	1.104987	.015725	.3069396	1.074068	1.135906
Measles knowledge	381	1.317585	.0238816	.4661493	1.270629	1.364542
Measles immunisation importance	381	1.351706	.0244954	.4781307	1.303543	1.399869
Measles vaccines schedule	381	1.769029	.0216201	.4220082	1.726519	1.811539
Knowledge of signs and symptoms of measles	381	1.456693	.0255531	.498776	1.40645	1.506936
Parent/Caregiver turned away, no MCV	381	1.84252	.0186858	.364732	1.805779	1.87926
Parents'/Caregivers' attitude towards mass campaigns attendance	381	1.165354	.0190575	.3719885	1.127883	1.202826
Parents'/Caregivers' knowledge about failure to vaccinate	381	1.099738	.0153717	.3000437	1.069513	1.129962
Parent/Caregiver under the impression a child is fully immunized	381	1.060367	.0122177	.2384796	1.036345	1.08439

3.4.7 Data analysis

The purpose of data analysis is to study values about human social immunisation to develop theories that help us explain, understand and make sense of the social world (Babbie *et al* 2013:6). Data analysis outcomes are the most direct evidence of the results.

Data were analysed using IBM Statistical Package for Social Science (SPSS). Computing descriptive and inferential statistics were used for the purpose of the study. Data were then presented in tables and figures where appropriate, but focusing mainly on the dispersion of the variables. Categorical variables were

presented using frequency and percentages, and continuous variables were shown as mean and standard deviations.

Spearman's correlation coefficient was applied to determine the strength between the independent variables. The results were analysed according to the degree of association considering significant correlation. Comparisons between groups were accomplished using chi-square and independent sample *t*-tests. Chi-squared tests the association observed on a sample reflecting a statistical association between the independent and dependent variables at the level of the entire population. Chi-squared statistics compare different levels of variables by measuring the strength of association between two nominal values and the probability that the sample at hand comes from a population where there is no association (Antonius 2013:235). An independent sample *t*-test was developed to examine the differences between two independent groups. A *p*-value of 0.05 was considered statistically significant (Grove *et al* 2013:580).

3.5 VALIDITY AND RELIABILITY

3.5.1 Validity

Validity is defined as the degree to which what was observed or measured is the same as what was claimed to be observed or measured (Rosnow & Rosenthal 2013:356). The construct validity methodology of the study was constructed in such a way as to intensify the measures of the variables as it influences the outcomes of the study and the understanding of the construct in the study framework.

Internal validity: There were no changes in instrumentation as the structured questionnaire was used to interview the participants at a single point in time to avoid maturation and subject attrition. Maturation is defined as when one gains more experience and hungrier during the study, which can influence the findings of the study.

Statistical conclusion validity: The researcher used a sufficiently large sample and precision by having a targeted age group of children between six months and 14 years (Grove *et al* 2013:199).

3.5.2 Reliability

Reliability is the level to which observations are consistent and constant (Rosnow & Rosenthal 2013:353). Reliability has to be greater in the instrument used to minimise random error in a measurement. This means that the measurements should be equivalent, even when data are collected by two different researchers. Internal consistency-. Homogeneity of variance (Table 3.2) was utilized to measure the extent that the data collection instrument measures the same traits. The alternate hypothesis for all the variables was statistically significant with assumption of the hypothetical mean to be equal to 1.

There are three phases of random error in this study, namely the measurement method used, the study participants and the researcher gathering data. Random error was avoided, using the following factors in this study (Polit & Beck 2012:176):

- Measurement method (Appendix 1): Structured questionnaires and an observational checklist were used to interview the participants.
- Study participants: An information leaflet (Appendix 2) was issued with the consent form (Appendix 3) stating the anonymity and confidentiality to increase the participant's candour. Interviewing was done in the morning when the clinic was not busy and while the participants were waiting for the patients' files before they were exhausted and fatigued from waiting.
- The researcher: Structured questionnaires and an observational checklist were used to interview the participants and reduce the possibility of the researcher and the research assistant only observing immunisation in order to keep with predetermined ideas.

3.6 ETHICAL CONSIDERATION

Ethics involves morality, integrity, equality and openness. Morality is about the right and wrong actions, and integrity is about honesty and truthfulness in doing that

action. Ethics are central to social research to protect human beings or objects involved from harm that may be brought by the research (Leavy 2017:24).

3.6.1 Research ethics compliance

Institution research bodies are established in universities to ensure that ethical standards, such as the protection of human subjects, are applied. The researcher obtained approval from the University of South Africa Research Committee (Annexure A) to continue conducting the research (Leavy 2017:32). The researcher also obtained approval from the Department of Health in Gauteng, Tshwane District (Annexure B), allowing the researcher to use the health care facilities in Region 2 as the research setting. Nine health facility managers were approached and allowed the researcher to use their specific facility.

3.6.2 Informed consent

Verbal presentation of the research was conducted at the waiting room, emphasizing the information leaflet given to participants. Further clarity was emphasized on the “capture audience” as the study was conducted in a health care facility where other participants may feel that if they do not participate, they might not be offered the service by the facility. After the participants were given verbal information, consent forms (Appendix 3) were given to those volunteering to participate in the study to read and sign to give permission to be questioned. Only those who signed the consent form were interviewed. No participant was coerced into participating in the study.

3.6.3 Beneficence and non-maleficence

The procedures, risks and harm in this study were explained to the participants in full. This study produced positive and identifiable benefits to the participants as they gained knowledge about measles at the debriefing session after data collection was completed and less harm with no risks was done (Singh 2013:29).

3.6.4 Anonymity and confidentiality

A unique ID was used on the questionnaire form for privacy and confidentiality purposes to respect the participants. Only the consent form included the name of the participants, which was saved in a locked file drawer only available for use by the researcher and the supervisor (Grove *et al* 2013:518). The research data records will be securely archived for 5 years, and then a burning method will be used to discard the information.

3.6.5 Autonomy

The aims and objectives of the study were fully disclosed to the participants, as stated on the information leaflet. The research participants' values and decisions were respected. Those who decided to withdraw from participating in the study were respected and allowed to do so without risk of prejudicial treatment (Gray *et al* 2016:164).

3.6.6 Debriefing

After every session, all the participants were educated about measles immunisation programme and also asked about any unsatisfactory matter or grievance to clear misconceptions and anxieties the participants may have had. They were informed that the results would be available to them on the address stipulated on the information leaflet and at their different health care facilities where the study was conducted. Debriefing helped the researcher to discover any problems generated by the research experience so that those problems could be corrected. The participants who were comfortable to state their complaints were advised to do so privately with the researcher. Those who felt uncomfortable in doing so were asked to address it with the health facility manager.

3.7 CONCLUSION

In this chapter, the research design and methods for the study were discussed. The data collection method, including the data collection process and procedure, data management, data coding and data analysis were explained further. The following chapter focuses on the analysis of the data and the findings.

CHAPTER 4

DATA PRESENTATION, ANALYSIS AND DESCRIPTION OF THE RESEARCH RESULTS

4.1 INTRODUCTION

The aim of the study was to determine the measles immunisation status and dropout rate among children aged between six months and 14 years residing in Hammanskraal, City of Tshwane. Data as collected by interviewing the caregivers with the use of structured questionnaires, and the Road to Health Booklet/Card was inspected for measles immunization status. The findings were presented to answer the research questions of this study regarding the following variables, namely demographic characteristics, measles vaccine coverage and the dropout rate of the measles immunisation programme.

In this chapter, the data analysis and data presentation are presented, followed by a summary of the findings. First, the findings are deduced using descriptive statistics, followed by an exploration and discussion of those findings applying inferential statistics with the use of statistical software IBM SPSS Version 23 and Microsoft Excel. Furthermore, Spearman's correlation coefficient was applied to test the relation between socio-economic status, knowledge, attitude and perception. A chi-square analysis testing the significance of the association between socio-economic status, knowledge, attitude and perception was also presented.

4.2 QUANTITATIVE DATA MANAGEMENT AND ANALYSIS

The targeted sample size was 377, but there were four extra participants to increase the population to 381, thereby increasing the power of the study to a bit more than 100%. This study consisted of a final sample size of 381 participants. One participant was eligible, but the RTHB/C was a duplicate with an immunisation record from six years of age.

4.3 RESEARCH RESULTS

4.3.1 Demographic characteristics of children

The demographic characteristics of the children participants are presented in Table 4.1.

Table 4.1: Demographic characteristics of children (n=381)

Characteristic	Variables	Frequency(n)	Percentage (%)
Age	6-11 months	142	37.3
	1-4 years	215	56.4
	5-9 years	19	5
	10-14 years	5	1.3
Total		**381**	**100**
Gender	Male	209	54.9
	Female	172	45.1
Total		**381**	**100**

4.3.1.1 Age

The majority of the children belonged within the age group of one to four years, 215 (56,4%) followed by 142 (37,3%) children aged between 6 and 11 months and then lastly, five (1,3%) belonging to the age group 10 to 14 years of age, as shown in Table 4.1.

4.3.1.2 Gender

Out of the 381 children, 209 (54, 9%) were boys compared to the 172 (45, 1%) girls, as shown in Table 4.1 above.

4.3.2 Current measles immunisation status

The researcher categorized the measles immunisation status into four groups, considering the age appropriateness of immunisation:

- Fully immunized referred to all children who were immunized with the 1st dose at six or nine months, respectively, and were not yet 12 months of age, and those who received the 2nd dose for the age of 12 or 18 months, respectively, at the time of the study.
- Catch-up children referred to those who had received their measles immunisation at a later-than-expected age for a measles vaccine.
- Partially immunized referred to children above 12 months of age, who received the 1st dose of the measles vaccine and did not receive a catch-up measles vaccine for the 2nd dose at the time of the study.
- Totally unimmunized referred to children who neither received the 1st nor the 2nd dose at the time of the study and are above the expected age of measles immunisation.

The results are presented in Table 4.2.

Table 4.2: Current measles immunisation status (n=381)

Category	Frequency (n)	Percentage (%)
RTHB available	381	100
Full measles immunisation	365	95.8
Measles 1st dose at six months	319	83.7
1st dose at nine months	54	14.1
1st dose catch-up	3	0.79
1st dose never immunized	5	1.3
Total	**381**	**100**
Measles 2nd dose at 12 months	172	72.0
2nd dose at 18 months	50	20.9
2nd dose catch-up	6	2.5
2nd dose never immunized	11	4.6
Measles 2nd dose total	**239**	**100**
Totally unimmunized	5	1.3
Missing	376	98.7
Total	**381**	**100**

Of the 381 children who had participated in this study, 365 (95,8%) were fully immunized and all 381 (100%) were in possession of an RTHB/C. A total of 319 (83,7%) children were given their 1st dose of the measles vaccine when they were six months old, followed by 54 (14,1%) children being given their 1st dose of the measles vaccine at nine months of age and only three (0,79%) were given their 1st dose of the catch-up measles immunisation.

Regarding the 2nd dose of the measles immunisation, only 239 (62,7%) of the children were included as children below 12 months of age are not eligible for MCV2. The 2nd dose is administered at 12 months of age to 173 (72%) children, followed by 50 (20,9%) children given the 2nd dose at 18 months of age, and only 6 (2,5%) children were given the 2nd of the catch-up measles immunisation. It is also interesting to note that 11 (4,6%) children were recorded as never having had the 2nd of immunisation, according to results shown in Table 4.2. Only 5 (1,3%) children in this study have never had their immunisation.

4.3.3 Measles dropout rate

The dropout rate in this study refers to the percentage of children who started the initial measles immunisation, but failed to return for a second dose of that specific vaccine. From the survey of records in this study, the dropout rate between MCV1 and MCV2 was found to be 4, 1%, as calculated from Table 4.2 above.

4.3.4 Related parent factors contributing to the measles immunisation status and dropout rates

Several other factors are directly related to the immunisation status and dropout rates of immunisation activities in children. One common factor is parents' contribution factors to immunisation status and dropout rates in terms of demographic characteristics, knowledge, attitudes and perceptions relating to measles immunisation activities. In this study, the frequency distribution of the following parent-related factors contributing to the immunisation status and dropout rates are presented in Table 4.3 below**.**

4.3.4.1 Caregivers' educational level

Table 4.3 indicates the educational level of the parents and caregivers in this study. Educational level was included to determine the participants' level of literacy. A total of 205 (53,8%) of the participants had matric, with 148 (38,8%) having no formal

education. On the other hand, only 27 (7,1%) had a degree/diploma and 1 (0,35%) of the caregivers had attained a postgraduate tertiary education.

4.3.4.2 Caregivers' employment status

A total of 299 (78, 5%) parents were unemployed, compared to the 67 (17,6%) who were employed and 13 (3,4%) who were self-employed.

4.3.4.3 Parent of the child

The results from Table 4.3 below reveal that 89,5% of the research participants were the parents of the respective children, compared to 10,5% who were guardians. This can be translated to the fact that the majority of the biological parents seemed to be responsible for the welfare of their children.

4.3.4.4 Knowledge of measles

A total of 260 (68,2%) participants who were referred to as the parents of the children, were knowledgeable about the measles disease compared to 121 (31,8%) parents who seemed to be less informed about the disease called measles, as shown in Table 4.3.

4.3.4.5 Importance of measles immunisation

The parents were also asked about the importance of measles immunisation, as shown in Table 4.3 below. Of the 381, 247 (64,8%) disclosed to have knowledge of the importance of immunizing their children against measles, compared to only 134 (35,2%) of the caregivers in this study who have no knowledge of the fact that measles immunisation is important for their children.

Table 4.3: Frequency distribution of related parent factors contributing to measles immunisation status and dropout rates (n=381)

Variable	Category	Frequency(n)	Percentage (%)
Educational level			
• No formal education		148	38.8
• Matric		205	53.8
• Degree/diploma		27	7.1
• Postgraduate		1	0.26
Employment status			
• Unemployed		299	78.5
• Self-employed		13	3.4
• Employed		67	17.6
Biological parent	yes	341	89.50
	no	40	10.5
Measles knowledge	yes	260	68.2
	no	121	31.8
Measles immunisation importance	yes	247	64.8
	no	134	35.2
Measles vaccines schedule	yes	88	23.1
	no	293	76.9
School health programme policy and regulation (immunisation) knowledge	yes	209	54.9
	no	172	45.1
Knowledge of signs and symptoms of measles	yes	207	54.3
	no	174	45.7
Parent/Caregiver turned away, no MCV	yes	60	15.7
	no	321	84.3
Parents'/Caregivers' attitude towards mass campaigns attendance	yes	318	83.5
	no	63	16.5
Parents'/Caregivers' knowledge about failure to vaccinate	yes	343	90
	no	38	10
Parent/Caregiver under the impression a child is fully immunized	yes	358	94
	no	23	6

4.3.4.6 Knowledge of measles vaccine schedule

According to Table 4.3 above, 293 (76,9%) parents lack the knowledge of a measles vaccine schedule, compared to 88 (23,1%) of the parents in this study knowing about the eligible age for the provision of measles immunisation.

4.3.4.7 Knowledge of school health regulations

The parents were questioned about their knowledge of the school immunisation regulations, as shown in Table 4.3 above. The results discovered that 209 (54, 9%) parents had knowledge of the school immunisation regulations, compared to 172 (45,1%) parents showing a lack of knowledge about the policies and regulations of the School Health Programme.

4.3.4.8 Signs and symptoms of measles

According to Table 4.3, out of 381 parents, 207 (54,3%) had knowledge of measles signs and symptoms, as compared to 174(45,7%) without knowledge about clinical manifestations of measles disease.

4.3.4.9 Lack of measles vaccines in clinics

Results from Table 4.3, illustrated that 321 (84, 3%) of 381 parents' children attending immunisation programme were offered measles vaccines as compared to 60 (15, 7%) parents who were turned away due to lack of measles vaccines.

4.3.4.10 Parents visiting mass immunisation campaigns

Table 4.3 explains that 318 (83, 5%) parents' children attend mass immunisation campaigns compared to 63 (16,5%) parents who do not take their children for SIAs.

4.3.4.11 Knowledge of the negative health impact

Parents were asked about negative health impact due to failure to immunize. A total of 343 (90%) parents were aware of the negative effects that are likely to be generated for not vaccinating their children as compared to 38 (10%) parents with no knowledge about negative health impact posed on their children if they are not immunized.

4.3.4.12 Parents' perceptions about child's measles immunisation status

The majority of the parents 358 (94%) thought that their children were fully immunized for measles as compared to 23 (6%) parents, who believed their children lack full protection from measles disease.

4.3.5 Correlation of related parent factors contributing to measles immunisation status and dropout rates

The Spearman's correlation coefficient using bivariate analysis was done to determine the direction and strength of the relationship between the following variables, namely parent's demographic factors, parent's measles knowledge, parent's attitude towards measles immunisation and perception about measles immunisation, which all contributes to the immunisation status and dropout rates.

4.3.5.1 Correlation to educational level

There was a positive significant correlation between the education level of the parents and their current employment status (correlation coefficient=0.157**, *p*=0.0002) and knowledge of the School Health Programme Policy (correlation coefficient=0.108*, *p*=0.035). However, there was also a significant negative correlation between the education level of the parents with measles knowledge (correlation coefficient=-0.244**, *p*=0.000), measles immunisation importance (correlation coefficient=-0.194**, *p*=0.000) and the measles vaccine schedule (correlation coefficient=-0.138**, *p*=0.007), as shown in Table 4.4 below**.**

4.3.5.2 Employment status correlation

The current employment status of the parents negatively correlated significantly with measles knowledge (correlation coefficient=-0.139**, *p=0.006*) and the importance of measles and immunisation (correlation coefficient=-0.121**, p=0.018*), according to Table 4.4***.***

Table 4.4: Correlations of related factors associated with participation in the measles immunisation programme (n=381)

	Education level	Employment status	Measles knowledge	Immunisation importance	Measles vaccine schedule	School health program	Measles signs	Turned back, no MCV	Mass campaigns	Knowledge about failure to vaccinate	Measles fully immunised
Education level											
Employment status	**0.157** (0.002**)						-				
Measles knowledge	**-0.244** (0.000)**	**-0.139** (0.006)**									
Immunisation importance	**-0.194** (0.000)**	**-0.121* (0.018)**	**0.383** (0.000)**								
Measles vaccine schedule	**-0.138** (0.007)**	0.010 (0.846)	0.066 (0.197)	**0.195** (0.000)**							
School health program policy	**-0.108* (0.035)**	-0.058 (0.259)	**0.152** (0.003)**	**0.182** (0.000)**	-0.016 (0.757)						
Measles signs	-0.057 (0.266)	-0.098 (0.057)	**0.359** (0.000)**	**0.318** (0.000)**	**0.140** (0.006)**	**0.301** (0.000)**					
Turned back, no MCV	-0.004 (0.932)	-0.004 (0.932)	**-0.123* (0.016)**	-0.044 (0.395)	-0.032 (0.536)	0.001 (0.981)	-0.038 (0.464)				
Mass campaigns	-0.024 (.641)	0.000 (0.999)	**0.197** (0.000)**	0.072 (0.163	0.060 (0.246)	0.036 (0.480)	0.088 (0.085)	-0.060 (0.245)			
Knowledge about failure to vaccinate	0.003 (0.950)	-0.043 (0.408)	**0.168** (0.001)**	**0.250** (0.000**)	0.058 (0.261)	0.068 (0.187)	**0.205** (0.000)**	-0.048 (0.345)	**0.111* (0.030)**		
Measles fully immunised	-0.029 (0.575)	-0.045 (0.381)	-0.040 (0.435)	0.021 (0.683)	-0.044 (0.390)	**0.102* (0.046)**	-0.011 (0.828)	**-0.163** (0.001)**	**-0.124* (0.015)**	-0.026 (0.613)	

4.3.5.3 Relation to measles knowledge

Measles knowledge correlated positively with immunisation importance (correlation coefficient=0.383**, *p=0.000*), the School Health Programme Policy (correlation coefficient=0.152**, *p=0.003*), signs of measles (correlation coefficient=0.359**, *p=0.000*), mass campaigns (correlation coefficient=0.197**, *p=0.000*), and knowledge about failure to vaccinate (correlation coefficient=0.168**, *p=0.001*), the correlations were strongly statistically significant respectively. However, there was an equally statistically significant negative correlation between knowledge about measles and parents who were turned back with their children because of a lack of measles vials (correlation coefficient=-0.123*, *p=0.016*), as shown in Table 4.4 above.

4.3.5.4 Importance of measles immunisation

The importance of measles immunisation correlated positively and significantly with the measles vaccine schedule (correlation coefficient=0.195**, *p=0.000*), the School Health Programme Policy (correlation coefficient=0.182**, *p=0.000*), signs of measles (correlation coefficient=0.318**, *p=0.000*) and knowledge about failure to vaccinate (correlation coefficient=0.250**, *p=0.000*), as shown in Table 4.4.

4.3.5.5 Correlation to measles vaccine schedule

Comparable to the importance of measles immunisation, knowledge about the measles vaccine schedule also correlated positively and significantly with the knowledge of the signs and symptoms of measles (correlation coefficient=0.140** *p=0.006*), as illustrated in Table 4.4 above.

4.3.5.6 School Health Programme correlation

Knowledge of the School Health Programme positively correlated with the signs and symptoms of measles (correlation coefficient=0.301**, *p=0.000*) and the caregivers' perception that the child was fully immunized (correlation coefficient=0.102*, *p=0.046*), the correlation was statistically significant, as depicted in Table 4.4.

4.3.5.7 Relation to the signs and symptoms of measles

The signs and symbols of measles correlated positively and significantly with knowledge of failure to vaccinate (correlation coefficient=0.205**, *p=0.000*), as shown in Table 4.4.

4.3.5.8 Correlation to caregivers turned away

There was a negative significant correlation between caregivers turning back due to MCV shortage and caregivers' perception that the child was fully immunized (correlation coefficient=-0.163**, *p=0.001*). Correlation was statistically significant, as depicted in Table 4.4.

4.3.5.9 Caregivers' attitude towards mass campaigns

The caregivers' attitude towards mass campaigns correlated positively and significantly with caregivers' knowledge for failure to vaccinate (correlation coefficient=0.111*, *p=0.030*) and caregivers perception that child was fully immunized (correlation coefficient=0.124*, *p=0.015*), as shown in Table 4.4.

4.4 OVERVIEW OF THE RESEARCH FINDINGS

The participants' children's ages ranged from six months to 14 years, with the most represented age group being 1-4 years, followed by 6-11 months. The male children were

dominant. The majority of the caregivers were unemployed with matric as their highest educational level.

The measles immunisation coverage was found to be high in this study with a low dropout rate. This is because the majority of the caregivers ensured that their children were fully immunized for measles. Some caregivers who defaulted the measles immunisation ensured that their children catch up to be protected from measles infection. However, a few caregivers (1%) did not vaccinate their children, posing them to unnecessary risk to this vaccine-preventable disease.

The researcher observed that the caregivers who had participated in this study were concerned about their children's well-being and knew the importance of immunisation as they brought them for immunisation services to ensure a healthy lifestyle. The researcher also observed that the majority of the caregivers had knowledge about measles as a disease; however, clinical manifestation and measles vaccine schedule knowledge were not commendable. This indicates that community health awareness programme should be strengthened in order for the Tshwane Health District and National Department of Health to continue achieving goals of high measles immunisation coverage and a low dropout rate. Despite a lack of health information and education on the measles immunisation vaccine schedule and a few caregivers returning due to measles vaccine shortage, the majority who fully immunized their children for measles adhered to the immunisation schedules. This might be due to their knowledge of the severity of the measles disease and the consequences if they fail to vaccinate.

The majority of the caregivers had the perception that their children were fully immunized, because the majority attended measles mass campaigns that had been offered. Moreover, the majority of the caregivers know that their children must adhere to school health policies regarding immunisation

Spearman's correlation coefficient tested the association between caregivers' educational level, employment status, knowledge, attitude and perception. Caregivers' educational level

has significant association with most of the variables. This indicates that caregivers' decision to vaccinate is dependent on educational level. Knowledge of measles and importance of immunisation were associated with signs of measles.

4.4 CONCLUSION

In this chapter, the research findings were discussed. Turning back caregivers who came for immunisation services due to vaccine shortages has a huge impact on the completion of the immunisation schedules. Knowledge of measles in general by caregivers increases the chance of fully immunizing their children. The researcher depicted that the caregivers of children in Hammanskraal were aware of the measles immunisation and had a good attitude and perception in completing immunisation schedule. The researcher also found that caregivers' educational level has an enormous impact on immunisation intake as the level of understanding gives one the capacity to make good decisions for their health and that of their children. In the following chapter, the findings are discussed in detail, including the overall conclusion and recommendations of this study.

CHAPTER 5

RESEARCH FINDINGS, RECOMMENDATIONS AND CONCLUDING REMARKS

5.1 INTRODUCTION

The research findings were analysed and interpreted, and discussed in detail in relation to previous studies and in conformity with the research questions. Spearman's correlation test was applied to find association of correlation coefficient and *p*-value for the following independent variables, namely socio-economic status, caregivers' knowledge, attitude and perception of measles. This association was carried out to find the strength and power of how independent variables influence the measles immunisation status of children. The limitations to, and the recommendations and overall conclusion of the findings of the study are included in this chapter.

5.2 DISCUSSION OF FINDINGS

5.2.1 Demographic characteristics of children

5.2.1.1 Age

The demographic composition of the children who were selected for this study showed that the combined percentage of preschool-aged children which comprise the ages 6-11 months and 1-4 years was 93,7% (n-351), which accounted for a significant number compared to school children aged 5-9 years and 10-14 years, which accounted for 6,3% In understanding the disparity in demographic composition, children immunisations for preschool children aged six months to four years are provided for at health care facilities such as hospitals or municipal clinics. However, for school children aged 5-14 years vaccines are administered by dedicated health care professionals at various school facilities, which could be considered transitional as the responsibility of immunisation has been transferred to the school and the

health care professional assigned to the school. The implication of transitional vaccine protocols from preschool age at the health care facilities to school health care facilities could result in the lack of a comprehensive health monitoring mechanism in order to ensure the prevention of a disease outbreak such as measles.

5.2.1.2 Gender

The gender disparity, as presented in Table 4.1, showed the dominance of male children compared to female children, which were 54,9% and 45,1%, respectively. The basis for gender disparity is not universal, but dependent on the birth ratio in a targeted region. For instance, similar gender demography with 54.09% of males and 45.9% of females was reported in a study conducted in South Africa (Ndwandwe *et al* 2020:5). Contrary to this study, it was reported that female children accounted for 53,6% compared to male children, which accounted for 46,4% in a study conducted in the southeast region of Nigeria (Tagbo *et al* 2014:177). However, in a study conducted in Cape Town, no significant difference was found between children's gender (Blaauw, Daniels, Du Plessis, Koen, Koornhhof, Marais, Van Niekerk & Visser 2017:165). The inconsistent disparity in gender for immunisation could be considered based on factors such as birth ratio, religion and cultural beliefs, among other factors. In this study, it can be debated that the caregivers of male children seek immunisation services more than the caregivers of the female children population in Hammanskraal (South African Demographics and Health Survey 2016:22).

5.2.2 Current measles immunisation status

In this study, immunisation status refers to the overall immunisation of children of preschool or school ages and their immunisation update, while the dropout rate describes the non-adherence to the guideline requirement of children immunisation under three distinct descriptions, namely fully immunized, partly immunized and not immunized. In Hammanskraal, which represents the area under study, the measles immunisation coverage and dropout rate for children between the ages of six months and 14 years were determined

by inspecting RTHB/C only. All caregivers (100%) had their RTHB/C in their possession, as per requirement by the National Department of Health when a child is visiting a health facility.

According to EPI-SA, measles immunisation coverage should be at least 95% and above per district. The immunisation status and dropout rate in Table 4.2 showed that fully immunized measles coverage in Hammanskraal was 95,8%. Tshwane Sub-district 2 is known for its low immunisation coverage (Mphaka *et al* 2018:223; see Chapter 2: Figure 2.2). However, this study reported the opposite. This indicates the efficiency of immunisation services in Tshwane Sub-district 2 in conducting a regular measles immunisation service according to the schedule (Srivastava & Shankar 2017:52).

Immunisation delay and refusal, despite the availability of vaccines, puts the entire community at risk of outbreaks of vaccine-preventable diseases (Baggio & Getaz 2019:311). Of a total of 381 participants for this study, 11 (2,9%) children were partially immunized, as indicated in Table 4.2. Previous studies conducted in Italy and India reported 6,6% and 16,75% for partially immunized children (Kumari & Kumar 2018:429; Tavoschi *et al* 2019:7201). Factors related to vaccine hesitancy and attitudes towards immunisation are reasons children do not complete recommended immunisation schedules. Catching up the measles immunisations of the partially immunized, based on this study, substantially increased measles vaccine coverage by 3.29% (Tavoschi *et al* 2019:7 201).

The implication of non-immunisation makes children susceptible to infection (Moura, Braga, Nunes, Canto & Teixeira 2018:5). In this study, it was found that 1,3% of children were not immunized for measles. It is important to emphasize that the role of caregivers' low maternal education and socio-economic status are one of the factors that have been associated with the lack of measles immunisation (Gilbert, Gilmour, Wilson & Cantin 2017:1451). In addition, health facility-related factors, such as the lack of a vaccine and the lack of coordinated vaccine scheduling, also have an impact in the success of measles immunisation programme (Moura *et al* 2018:5).

5.2.3 Measles immunisation coverage per dose

5.2.3.1 Measles 1st dose

The administration of the appropriate dose, including coverage per dose, is one of the mitigation protocols to prevent the outbreak of vaccine-preventable diseases such as measles. Moreover, the recommended immunisation protocols involve the administration of the MCV1 and MCV2 vaccines. In Table 4.2, the measles immunisation coverage for the 1st dose was 97,8% for children within the age group of 6-11 months. In a previous study conducted in Tshwane Sub-district 2, the coverage per dose of immunisation was 95% for children at nine months of age. However, this coverage was for the combination of MCV1 and the 3rd dose of the pneumococcal conjugate vaccine before the change in the measles immunisation schedule in South Africa (Mphaka *et al* 2018:226). Moreover, previous studies reported coverage per dose for MCV1 immunisation at 98,44% and 94,8%, respectively (Majola 2018:34; Motloung 2016:31). It seems that the change in the South African measles immunisation schedule in 2015 did not have a significant impact on the immunisation uptake of children within the 6-11 months age group.

5.2.3.2 Measles-containing virus 2nd dose

According to the World Health Organization (WHO), the recommended coverage rate is 95% for both the 1st and 2nd dose of the MCV in order to eliminate measles. MCV2 is a complimentary immunisation protocol as it improves the coverage and efficacy of MCV immunisation (Li *et al* 2020:7). In this study, the MCV2 vaccines were 95,4%, which is above the level required for the herd immunity threshold (Coughlin *et al* 2017:2). Although the 95,4% coverage in this study surpasses the average Gauteng provincial reported MCV2 coverage of 74,5%, it is marginally below the provincial planned target of 96% for 2017/2018 (Gauteng Department of Health Annual Report 2018:42). In a similar study, 93, 9% coverage for MCV2 was reported in the Zhejiang province in China (Hu *et al* 2018:4). However, a study conducted in Diepsloot in Gauteng, South Africa reported MCV2 coverage of 78, 86%. (Majola 2018:31). This reported MCV2 coverage was considerably higher than the national MCV2 coverage,

which was reported at 50% for 2018 (World Health Statistics 2020:29). The variance in MCV2 coverage annually could be as a result of factors such as an immunisation roll-out mechanism, public health awareness and government priority areas within the health sector. In essence of herd immunity, at least 90% of MCV2 coverage showed that the WHO target for MCV2 is achievable (Hu *et al* 2018:4).

5.2.4 Measles dropout rate

The measles dropout rate refers to the percentage difference of children with partial and full immunisation. This is in relation to children who start the immunisation schedule for a specific vaccine at a health facility compared to the percentage who complete that specific vaccine recommended schedule. In this study, the dropout rate refers to the difference between MCV1 and MCV2. Although the coverage for MCV in Tshwane Sub-district 2 attained a 95% target set by WHO, the average disparities between MCV1 (98,59%) and MCV2 (95,4%) in this study showed a dropout rate of 3,2%, as shown in Table 4.2. It is noteworthy to indicate that the 3,2% dropout rate observed in this study was within the target set by the WHO, which is 10% or less (Baguune, Ndago & Adokiya 2017:6). The dropout rate analysis excludes children who are not immunized, in other words, those who did not receive the 1st dose, 2nd dose or catch-up dose of the measles vaccine (World Health Statistics 2020:21).

The low dropout rate could be attributed to a comprehensive vaccine roll-out and access to immunisation services. In a related study, the dropout rate was reported to be 4% and the shortage of vaccines was identified as the militating factor responsible for the dropout rate (Makwela 2018:32) In addition, other factors that have been discussed to contribute to the dropout rate include a change in a vaccine schedule, an increase in the children population (Gauteng Department of Health Annual Report 2018:42), a lack of educational awareness among caregivers (Oladepo, Dipeolu & Oladunni 2019:469) and delayed immunisation protocols. It is, therefore, imperative that an integrated immunisation mechanism, such as the reinforcement of WBOT; the use of e-health platforms, in other words, SMS notifications, are some of the measures that can be adopted (District Health Barometer 2019:150; Shikuku, Muganda, Amuga & Kisia 2019:8).

5.2.5 Factors associated with measles immunisation coverage

5.2.5.1 Correlation to educational level

The correlation analysis in Table 4.4 showed a positive significant association between the education level of the caregiver and the current employment status. This suggests that the higher the educational attainment of a caregiver is, the higher the chances are of them finding employment. This is crucial for reasons such as being able to understand the implications of measles immunisation and for the importance of overall health and growth. In a cross-sectional survey conducted in The Gambia, it was reported that low education was intricately responsible for unemployment among mothers, which was directly related to the delay in immunisation due to the prevailing socio-economic status (Odutola, Afolabi, Ogunbare, Okebe & Ota 2015:7). However, in a study conducted in China, it was found that highly educated mothers above senior middle school ($p<0.05$) and employed mothers ($p<0.01$) were associated with the delayed immunisation of MCV2 (Hu *et al* 2018:4). In this study, the majority of the caregivers were unemployed with a matric. The benefit of unemployment could be multifaceted, such that the caregivers are readily available to attend immunisation services, and their educational level equips them with the capacity to understand the importance of immunizing their children; hence, the high measles immunisation coverage and low dropout rate encountered in Tshwane Sub-district 2.

Moreover, the caregivers' education levels were found to be negatively and weakly associated with the knowledge of measles and the importance of immunisation. In previous studies conducted in South Africa and Sri Lanka, no statistical association was found between educational level and immunisation knowledge, and knowledge of the importance of immunisation (Jawayeera & Wijesinghe 2018:8; Ramavhoya, Maputle & Lebese 2015:13; Williams 2017:42). However, in a study conducted in Nigeria, a positive significant correlation was found between educational level and immunisation knowledge (.602; $p<.05$) (Adekeye, Ahmadu, Chenube & Adekeye 2015:94). Contrary to this study, in a study conducted in Switzerland, it was found that moderately highly educated mothers had a preference of

natural immunity compared to immunisation (Weiss *et al* 2016:5). Measles immunisation awareness campaigns and educational programme must be emphasized on knowledge about vaccines and their importance in order to encourage immunisation uptake (Srivastava & Shankar 2017:53).

A Road to Health booklet or card serves as a reminder of the next immunisation visit to the health facility. However, only those who can read English might understand the content of the booklet or card. In this study, it was found that a caregiver's educational level is negatively associated with the knowledge of the measles vaccine schedule. This suggests that the higher educated the caregivers are, the less knowledge they have about when a child should receive the measles vaccine injection. In a study comprising of the analysis of cross-sectional data for assessing the educational influence on the access of childhood immunisation, it was found that as educational attainment increased, the number of visits to public health programme for the systematic immunisation of children decreased. However, those parents were more likely to immunize for Human Papillomavirus (Mora & Trapero-Bertran 2018:7). In previous studies, it was found that low immunisation uptake is due to a lack of information to caregivers about what vaccine a child is receiving (Maseti 2015:98; Singh, Sahu, Agrawal & Vashi 2019:2).

5.2.5.2 Employment status correlation

In this study, an indirect significant association was found between employment status, the knowledge of measles and the importance of immunisation. Contrary to this study, in a cross-sectional study conducted in Sri Lanka, which assessed the maternal knowledge, perception and age-appropriate coverage of routine immunisation in children under five years, it was found that maternal occupation has an influence on maternal immunisation knowledge (Jawayeera & Wijesinghe 2018:8), even though it could be speculated that employed mothers are educated and have access and capacity to understand information. A community-based mixed method study was conducted to explore factors related to MR vaccine hesitancy resonated that employed mothers were more prevalent (OR -2.34, $p<0.001$) to have vaccine

hesitancy when compared to unemployed mothers (Krishnamoorthy, Kannusamy, Sarveswaran, Sarkar & Narayanan 2019:3 965).

5.2.5.3 Relation to measles knowledge

The knowledge of the community and caregivers about measles and immunisation is important in disease prevention and the potential reoccurrence of outbreaks (Brieger, Edwards, Mudgil & Whitehall 2017:641). In Table 4.4, the association between knowledge of measles, the importance of immunisation and signs of measles shows significant positive correlations in this study. It was reported that the mother of children who were aware of the importance of measles immunisation were more likely to immunize their children than mothers who have poor knowledge of measles (Abebe, Mengistu & Mekuria 2019:5; Rosadi, Sulaeman & Prasetya 2019:456). In studies conducted by Brieger *et al* (2017:644) and Toure *et al*(2014:1 758), however, the threat of an unfamiliar disease with unknown complications tended to scare individuals compared to measles with its deadly consequences as parents chose not to vaccinate their children even after surviving the measles infection. Caregivers of children who experienced less severe measles symptoms due to vaccine failure in previously immunized individuals might interpret measles as less severe and consequently hesitate to have their children immunized (Cherry & Zahn 2018:1 315).

A shortage of the vaccine has a direct negative impact on vaccine roll-out and immunisation coverage, and, therefore, the prevention of outbreaks. In Table 4.4, an equal statistically significant negative correlation between knowledge of measles and parents who were turned back with their children because of a lack of measles vials is shown. The implication of missed opportunity to vaccinate due to a shortage of the measles vaccine could have far-reaching consequences, including outbreaks. In a study conducted in the Eastern Cape, South Africa, irrespective of a vaccine shortage, it was revealed that caregivers ensure that they completely immunize their children (Le Roux, Akin-Olugbade, Katzen & Laurenzi 2017:55). Accordingly, involving and informing caregivers about the immunisation coverage, herd immunity and challenges faced by the health facilities, such as a vaccine shortage, may

result in better clinical outcomes to (Fernandez *et al* 2014:6; Logan, Nederhoff, Koch, Griffth & Basta 2018:4123).

5.2.5.4 Relation to the signs and symptoms of measles

The signs and symptoms of measles correlated positively and significantly with the knowledge of the failure to vaccinate, as shown in Table 4.4. In this study, it was revealed that as caregivers' knowledge of the signs and symptoms of measles increase, caregivers' knowledge of the need to vaccinate their children increase. Similar to the current study, in a cross-sectional study conducted in Indonesia to analyse the determinants of MR immunisation uptake, it was reported that the higher the perceived severity of mothers against measles, the greater the mothers' desires were to have the measles vaccine given to their children, given that the prevention of measles is only through immunisation (Rosadi *et al* 2019:456).

5.3 CONCLUSION

The objective of the study was to determine and identify the demographic characteristics, measles immunisation coverage and dropout rate among children aged six months to 14 years, and to assess the knowledge, attitude and perception of caregivers towards the measles immunisation programme. The total measles immunisation coverage and dropout rate attained in this study indicate good access and use of measles immunisation services by caregivers in Hammanskraal in Tshwane Sub-district 2. This can be attributed to the sound knowledge, positive attitude and perception of caregivers towards the measles immunisation programme.

5.4 RECOMMENDATIONS

5.4.1 Future scope

In the findings of this study, it was shown that other practices are important in increasing measles immunisation coverage and reducing dropout rates. Measles immunisation coverage studies with different research populations should be conducted in other Sub-districts of the country to monitor the weaknesses of the immunisation services as the population of this study was not equally representative of all ages. Community house-to-house RTHB screening should be done to target even those who have a bad attitude towards or fear of health facilities. A further qualitative research study is recommended to determine the reason for the lack of immunisations in order to find gaps in the immunisation programme.

Educating caregivers on the importance of measles immunisation and reminding them that the immunisation schedule can increase immunisation uptake. Media adverts and videos of vaccine-preventable diseases can be displayed at community public areas such as malls and taverns to create awareness and educate parents who do not visit health care facilities. Involving caregivers in knowing the impact of the contribution of immunizing their children is making a difference in protecting those who cannot immunize.

5.4.2 Department of Health

The Department of Health should strengthen their integration with the Department of Basic Education to emphasize and reinforce the School Health Policy, the screening process and verifying measles immunisation statuses of Grade 1 and Grade 8 pupils, including early childhood learning centres in order to detect the unimmunized children and advise their caregivers accordingly.

In South Africa, the Child Support Grant is money given to children under the age of 18 in order to alleviate poverty. To apply, only a child's birth certificate and caregivers' identity documents are required (Department of Social Development 2018:1). Re-applications are

done to renew social grant cards in order to avoid fraud. The Department of Health can integrate by including an RTHB booklet as part of the documents required for the re-application of child social grants. An HCW can then screen all children's immunisation statuses and advise accordingly for those children without a full immunisation history.

5.5 CONTRIBUTIONS OF THE STUDY

Previous studies have been conducted in South Africa about vaccine-preventable diseases, including measles, and factors affecting immunisation intake, but according to the researchers' knowledge, this study is the first to be conducted to evaluate the measles immunisation coverage and dropout rate between children aged between six months and 14 years in the City of Tshwane, Hammanskraal. The study also assisted in obtaining an in-depth understanding of the factors influencing the use of measles immunisation services by the caregivers of children.

5.6 LIMITATION AND STRENGTH

Cross-sectional studies conducted in health care facilities were used to classify measles immunisation coverage and factors associated with immunisation uptake. Even though health facility surveys are not representative, they result in desirable outcomes and directives to achieve the objectives of facilities (Cutts *et al* 2016:4107). This study was non-representative as target population was children from six months to 14 years of age. However, children above five years are provided immunisation at school facilities. Hence, this study cannot be used as a generalization to other regions.

The key limitation of this study is that it was conducted at health care facilities and only parents who are concerned about the health of their children are found in these facilities. Most of the parents of unimmunized children have no will to go to immunisation clinics. Moreover, the study excluded all children who came for other services at health care facilities other than the immunisation service.

5.7 CONCLUDING REMARKS

It was found that a lack of communication has a major impact and affects the next person's decision making. Some of the caregivers in this study lacked knowledge about the importance of immunisation. This is the core indicator of immunisation uptake. Caregivers can have knowledge of the most fatal diseases such as measles, but if they lack the knowledge of the benefit of the measles vaccine, chances of immunisation are less (Zewdie *et al* 2016:4). If that barrier to immunize is supplemented by caregivers being turned away due to a lack of vaccines at the health care facilities, the chances of their children receiving that missed vaccine are low (Wallace, Krey, Burnett and Duncan 2018:8). Continuous health care education about the immunisation programme, emphasizing its benefits and importance, may increase immunisation uptake.

In conclusion, even though caregivers from Hammanskraal in Tshwane Sub-district 2 lack the knowledge of the measles immunisation programme, their positive attitude towards, and perception of measles immunisation resulted in high measles immunisation coverage and low dropout rate.

LIST OF REFERENCES

Abad, CL & Safdar, N. 2015. The re-emergence of measles. *Current Infectious Disease Reports.17 (51)*. From: link.springer.com (Accessed 25 July 2019).

Abebe, AM. Mengistu, T & Mekuria, AD. 2019. Measles case, immunization coverage and its determinant factors among 12-23 month children, in Basona Worena Woreda, Amhara Region, Ethiopia, 2018. *BioMed Central Res Notes*. From: pubmed.ncbi.nlm.nih.gov (Accessed 25 December 2020).

Adekeye, OA. Ahmadu, F. Chenube, OO & Adekeye, BT. 2015. Knowledge, attitude and barriers towards children immunizatiob among women in selected rural primary health centres*. IFE PsychologIA*. From: ajol.info (Accessed 14 may 2020).

Andersen, RM.1995. Revisiting the Behavioural Model and access to medical care: does it matter? *Journal of Health and Social Behaviour*, 1-10. From: www.googlescholar.co.za (Accessed 2 December 2020).

Anekwe, DT, Newell, ML, Tanser, F, Pillay, D & Barnighausen, T. 2015. *The causal effect of childhood measles immunization on educational attainment: a mother fixed-effects study in rural South Africa.* From: www.ncbi.nlm.nih.gov (Accessed 13 March 2017).

Antonius, R. 2013. *Interpreting quantitative data with IBM SPSS Statistics*. 2nd ed. Sage Publications.

Anya, B, Okeibunor, J, Mihigo, R & Poy, A. 2018. *Efforts to reach more children with effective vaccines through routine immunisation in the WHO African Region: 2013-2015.* From: www.immunologyresearchjournal.com (Accessed 21 October 2019).

Aparasu, RR & Bentley, JP. 2014. *Principles of research design and drug literature evaluation.* Jones and Bartlett Learning.

Aung, Y & Dlamini, NR. 2018. District Health Barometer: Chapter 8 - Immunisation. *Health System Trust*. From www.hst.org.za (Accessed 12 April 2018).

Azam, JM. 2018. *Assessment of a measles outbreak response immunization campaign, two measles parameter estimation methods*. From: http://scholar.sun.ac.za (Accessed 5 September 2018).

Babbie, E, Halley, FS, Wagner, WE & Zaino, J. 2013. *Adventures in social research: data analysis using IBM SPSS Statistics.* SAGE Publications.

Baggio, S & Gétaz, L. 2019.Current gaps in vaccination coverage: a need to improve prevention and care. *International Journal of Public Health.* From: https://pubmed.ncbi.nlm.nih.gov (Accessed 03 May 2020).

Baguune, B, Ndago, JA & Adokiya, MN. 2017. Immunization dropout rate and data usability among children 12-23 months of age in Ghana. *Arch Public Health,* 1-8. From: pubmed.ncbi.nlm.nih.gov (Accessed 25 November 2019).

Baker, E. 2014. Socioeconomic status, definition. *Wiley Online Library*. From: onlinelibrary.wiley.com (Accessed 23 January 2020).

Barron, P. Peter, J. LeFevre, AE. Sebidi, J. Bekker, M. Allen, R. Parsons, AN. Benjamin, P & Pillay, Y. 2018. Mobile health messaging service and helpdesk for South African mothers (MomConnect): history, successes and challenges. *BMJ Glob Health*. 1-6. From: gh.bmj.com (Accessed 5 December 2020).

Bateman, C. 2016. Vaccines: SA's immunisation programme debunked. *SAMJ,* 106(4). From: www.scielo.org.za (Accessed 11 April 2018).

Bernhardt, G. Cameron, N. Willems, B. Boulle, A & Coetzee, D. 2013. Measles vaccination coverage in high-incidence areas of the Western Cape, following the mass vaccination

campaign. *South African Medical Journal*. From: www.samj.co.za (Accessed 12 January 2017).

Blaauw, R, Daniels, L, Du Plessis, LM, Koen, N, Koornhof, HE, Marais, ML, Van Niekerk, E & Visser, J. 2017. Assessing the utilization of a child health monitoring tool. *South African Journal of Child Health*. From: www.sun.ac.za (Accessed 24 January 2020).

Brieger, D, Edwards, M, Mudgil, P & Whitehall, J. 2017. Knowledge attitude and opinions towards measles and the MMR vaccine across two NSW cohorts, *Aust NZJ Public Health* 41(6):641-646. From: www.researchgate.net (Accessed 23 December 2020).

Bruce, N, Pope, D & Stanistret, D. 2018. *Quantitative methods for health research: a practical interactive guide to epidemiology and statistics.* 2nd ed. Wiley Publications.

Bryman, A. 2016. *Social research methods.* From: www.books.google.co.za. (Accessed 12 February 2019).

Burnett, RJ. Dlamini, NR. Meyer, C. Fernandez, L. Motloung, BR. Ndlovu, TH. Simango, HA. Kibuuka, DK. Dochez, C. Montwedi, DN. Nkwinika, VV & Mphahlele, MJ. 2019. Progress towards obtaining valid vaccination coverage data in South Africa. *South African Journal of Science*. From: www.sajs.co.za (Accessed 13 July 2020).

Canals, L. 2017. Instruments for gathering data. In E.Moore & M.Doly(Eds), *Qualitative approaches to research on plurilingual education*. From: https://files.eric.ed.gov (Accessed 10 August 2020).

CDC. 2016. Measles related MMWR articles www.cdc.gov (Accessed 12 May 2018).

CDC. 2018. Immunization: the basics. From: Cdc.gov (Accessed 30 November 2020).

Chakrabarti, A. Grepin, KA & Helleringer, S. 2019.The impact of supplementary immunization activities on routine vaccination coverage: an instrumental variable analysis in five low-income countries. *PLoS ONE* 14(2). From; journals.plos.org (Accessed 25 July 2020).

Cherry, JD & Zahn, M. 2018. Clinical characteristics of measles in previously vaccinated and unvaccinated patients in California. *Clinical Infectious diseases.* From: https://pubmed.ncbi.nlm.nih.gov (Accessed 08 March 2020).

Coughlin, MM. Beck, AS. Bankamp, B & Rota, PA. 2017. Perspective on Global Measles Epidemiology and Control and the Role of Novel Vaccination Strategies. *Viruses*. From: www.mdpi.com/journal/viruses (Accessed 15 April 2018).

Creswell, JW. 2013. Research design: Qualitative, quantitative and mixed methods approach. 4th ed. 4-20. From: www.books.google.co.za. (Accessed 4 April 2017).

Cutts, FT. Claquin, P. Danovaro-Holliday, MC & Rhoda, DA. 2016. Monitoring vaccination coverage: Defining the role of surveys. *Vaccine*. From: ncbi.nlm.nih.gov (Accessed 17 October 2019).

Cutts, FT. Ferrari, MJ. Krause, LK. Tatem, AJ & Mosser, JF. 2021. Vaccination strategies for measles control and elimination: time to strengthen local initiatives. *BioMed Central Medicine*. From: www.biomedcentral.com (Accessed 17 May 2021).

Davis, R & Mbabazi, WB. 2017. Challenges to global measles eradication: is it all in the timing? *The Pan African Medical Journal*. From: https://www.ncbi.nlm.nih.gov (Accessed 21 May 2021).

Davis, S. 2019. The what, why and when of childhood immunization in South Africa-2019. *Prof Nurs Today*. From: cdn.24.co.za (Accessed 7 September 2019).

Department of Health. 2015. *Cold chain and immunization: Operations Manual.* From: www.NDOH.org (Accessed 2 May 2018).

Dibakwane, ST & Peu, MD. 2018. Experiences of school health nurses regarding the provision of school health service delivery in the Tshwane district. *African Journal of Primary Health Care Family Medicine.* From: pubmed.ncbi.nlm.nih.gov (Accessed 25 January 2019).

Dlamini, NR & Maja, P. 2016. The Expanded Programme on Immunisation in South Africa: A story yet to be told. *SAMJ* 106(7):675-677 From: www.ajol.info (Accessed 13 March 2018).

Dube, E, Laberge, C, Guay, M, Bramadat, P, Roy, R & Bettinger, J. 2013. *Vaccine hesitancy: an overview*. From: www.landesbioscience.com (Accessed 12 June 2018).

Efrom, SE & Ravid, R. 2019. Writing the Literature Review: A practical guide. *The Guilford Press*. https://onlinelibrary.wiley.com (Accessed 17 September 2020).

Eom, H, Park, Y, Kim, J, Yang, J-S, Kang, H & Kim, K. 2018. *Occurrence of measles in a country with elimination status: Amplifying measles infection in hospitalized children due to imported virus.* From: htpp://journals.plos.org (Accessed 20 March 2019).

Eye Witness News. 2017. *Gwen Ramokgopa, Gauteng Health MEC. Measles outbreak confirmed in Gauteng.* 7 May 2017. From: http://ewn.co.za/2017/05/07/ramokgopa-confirms-measles-outbreak-in-gauteng (Accessed 9 October 2017).

Facciola, A. Visalli, G. Orlando, A. Bertuccio, MP. Spataro, P. Squeri, R. Picerno, I & Di Pietro, A. 2019. Vaccine hesitancy: An overview on parents' opinion about vaccination and possible reasons of vaccine refusal. *Journal of Public Health Research*. From: https//pubmed.ncbi.nlm.nih.gov (Accessed 30 April 2020).

Feldstein, LR, Mariat, S, Gacic-Dobo, M, Diallo, MS, Conklin, LM & Wallace, AS. 2016. *Global Routine Immunization Coverage, 2016*. 66(45). From: www.ncbi.nim.nih.gov (Accessed 15 May 2018).

Ferguson, A & Master, Z. 2016. Multisite research ethics review: Problems and potential solutions. *BioéthiqueOnline*. From: erudite.org (Accessed 01 January 2020).

Fernandez, L. Rossouw, T. Marcus, T. Reinbrech-Schutte, A. Smit, N. Kinkel, HF. Memon, S & Hugo, J. 2014. Factors associated with patients' understanding of their management plan in Tshwane clinics. *African Journal of Primary Health Care & Family Medicine*. From: www.ncbi.nlm.nih.gov (Accessed 28 September 2020).

Fiebelkorn, AM, Seward, JF & Orenstein, W. 2014. *A global perspective of immunization of healthcare personnel against measles: systematic review.* From: http://scholar.google.co.za (Accessed 10 March 2018).

Flick, U. 2018. *An introduction to quantitative research.* 6th ed. Sage Publications.

Funk, S. Knapp, JK. Lebo, E, Reef, SE. Dabbagh, AJ. Kretsinger, K. Jit, M. Edmunds, WJ & Strebel, PM. 2017. Target immunity levels for achieving and maintaining measles elimination. *BioMed Central Medicine*. From: biorxiv.gov (Accessed 25 September 2020).

Furuse, Y & Oshitani, H. 2017. *Global transmission dynamics of measles in the measles elimination era.* From: www.ncbi.nlm.nih.gov (Accessed 28 September 2018).

Frey, BB. (ed). 2018. *The SAGE Encyclopedia of Educational Research, Measurement and Evaluation.* From: methods.sagepub.com/reference (Accessed 30 November 2020).

Gauteng Department of Health Annual Report. 2018. Department of Health Province of Gauteng Vote No.4 Annual Report financial year 2017/2018. PR 335/ 2018. From: provincialgovernent.co.za (Accessed 15 August 2019).

Gastanaduy, PA & Goodson, JL. 2017. *Chapter 3: infectious disease related to travel: measles (rubeola)*. From: wwwnc.cdc.gov (Accessed 19 April 2018).

Gilbert, NL. Gilmour, H. Wilson, SE & Cantin, L. 2017. Determinants of non-vaccination and incomplete vaccination in Canadian toddlers. *Human Vaccines and Theraupetics*. From: ncbi.nlm.nih.gov (Accessed 12 April 2019).

Glasper, A & Rees, A. 2016. *Nursing and Healthcare Research at a Glance.* From: http://books.google.co.za (Accessed 10 October 2017).

Government Gazette No 19377. National Education Policy Act dated 19 October 1998. a-9. From: www.elrc.org.za (Accessed 5 September 2018).

Gray, JR. Grove, SK & Burns, N. 2013. *The practice of nursing research: appraisal, synthesis and generation of evidence.* 7th ed. Elsevier.

Gray, JR. Grove, SK & Burns, N. 2016. *The practice of nursing research: appraisal, synthesis and generation of evidence.* 8th ed. Elsevier.

Griffin, DE. 2018. Measles vaccine. *Viral Immunology*. From: ncbi.nlm.nih.gov (Accessed 28 October 2019).

Grove, SK. Gray, JR & Burns, N. 2013. *Understanding nursing research: building an evidence-based practice.* 6th ed. From: www.books.google.co.za. (Accessed 16 March 2017).

Guha-Sapir, D. de Almeida, MM. Scales, SE. Ahmed, B & Mirza, I. 2020. Containing measles in conflict-driven humanitarian settings. *BMJ Global Health*. From: gh.bmj.com (Accessed 15 December 2020).

Haddison, EC. Machingaidze, S. Wiysonge, CS. Hussey, GD & Kagin, BM. 2018. An update on trends in the types and quality of childhood immunization research outputs from Africa 2011-2017: Mapping the evidence base. *Elsevier.* From: ncbi.nlm.nih.gov (Accessed 30 March 2020).

Haji, A, Lowther, S, Ngan'ga, Z, Gura, Z, Tabu, C, Sandhu, H & Arvelo, W. 2016. Reducing routine immunization drop-out rates: evaluating two interventions in three Kenyan districts, 2014. *BioMed Central Public Health.* From:bmcpublichealth.biomedcentral.com (Accessed 29February 2019).

Health System Trust. 2016. Section B Profile Gauteng Province: indicator performance, Tshwane. 397. From: www.hst.org.za (Accessed 25 January 2020).

Holzmann, H, Hengel, H, Tenbusch, M & Doer, HW. 2016. *Eradication of Measles: Remaining Challenges* 205(3). From: link.springer.com (Accessed 12 May 2018).

Hong, H. Makhathini, L. Mashele, M. Malfeld, S. Motsamai, T. Sikhosana, L. Manamela,J. Ntshoe, G Motaze, NV. Smit, S. Maseti, E. Dlamini, N. Kamupira, M. McCarthy, K & Suchard, M. 2018. Annual measles and rubella surveillance review, South Africa, 2017. From: www.nicd.ac.za (Accessed 23 May 2020).

Hong, H. Makhathini, L. Mashele, M. Smit, S. Malfeld, S. Motsamai, T. Tselana, D. Manamela, MJ. Motaze, NV. Ntshoe, G. Kamupira, M. Khosa-Lesola, E. Mokoena, S. Buthelezi, T. Maseti, E. Maphoto, R & Suchard, M. 2019. Annual measles and rubella surveillance review, South Africa, 2019. From: www.nicd.ac.za (Accessed 23 May 2020).

Hossain, I. Mokaya, E & Mugoya, I. 2017. Evaluation of the initiative to strengthen Nurses' Expanded Programme on Immunization Pre-service training in Kenya. *Maternal Child Survival Program*. From: mcsprogram.org (Accessed 13 May 2021).

Hu, Y. Wang, Y. Chen, Y. Liang, H & Chen. Z. 2018. Measles vaccination coverage, determinants of delayed vaccination and reasons for non-vaccination among children aged 24-35 months in Zhejiang province, China. *BioMed Central Public Health*. From: bmcpublichealth.biomedcentral.com (Accessed 18 August 2020).

ISHP. 2012. Immunisation Policy. From: www.education.gov.za (Accessed 25 August 2017).

Jacob. N & Coetzee, D. 2015. Missed opportunities for immunisation in health facilities in Cape Town, South Africa. *SAMJ* 105(11):917-921 From: www.ajol.info (Accessed 4 May 2018).

Jawayeera, HAMD. Wijesinghe, CJ. 2018. Maternal knowledge, perceptions and age-appropriate coverage of routine immunisation in children under five years in Southern Sri Lanka. *Asian Journal of Pharmacy*, *Nursing and Medical Sciences* 06(01). From: www.googlescholar.co.za (Accessed 2 December 2020).

Kaiser, R, Shibeshi, ME, Chakauya, JM, Dzeka, E, Masresha, BG, Daniel, F & Shivute, N. 2015. *Surveys of measles immunization coverage in eastern and southern Africa: a review of quality and methods used.* From: www.scholar.google.co.za (Accessed 3 March 2018).

Krishnamoorthy, Y. Kannusamy, S. Sarveswaran, G. Majella, MG. Sarkar, S. Narayanan, V. 2019. Factors related to vaccine hesitancy during the implementation of Measles-Rubella campaign 2017 in rural Puduvherry-A mixed-method study. *Journal of Family Medicine primary care*. From: www.jfmpc.com (Accessed 29 November 2020).

Kumar, R. 2014. *Research methodology: a step-by-step guide for beginners.* 4th ed. London, *SAGE Publishers.*

Kumar, R. 2019. *Research Methodology: A Step-By-Step Guide for Beginners* (5th ed.) Thousand Oaks, CA. Sage.

Kumari, PL & Kumar, TR. 2018. Clinical and laboratory profile of children admitted with measles in a tertiary care teaching hospital. *Indian Journal of Child Health*. From: mansapublishers.com (Accessed 23 June 2019).

Kurane, AB & Swathi, D. 2018. A study of immunization status of children in the age group 2-5 years. *International Journal of Contemporary Pediatrics* 5(3).

Leavy, P. 2017. Research Design: Quantitative, qualitative, mixed methods, art based, and community based participatory research approach. *The Guilford Press New York*, London www.googlebooks.co.za (Accessed 07 April 2018).

Le Roux, K. Akin-Olugbade, O. Katzen, LS & Laurenzi, C. 2017. Immunisation coverage in the rural Eastern Cape- Are we getting the basics of primary care right? Results from a longitudinal prospective cohort study. *South African Medical Journal*. From: www.researchgate.net (Accessed 25 November 2019).

Ling, L & Ling, P. 2016. *Methods and paradigms in education research.* From: www.google.books.co.za (Accessed 29 December 2019).

LoBiondo-Wood, G. Haber, J. 2018. Nursing Research: Methods and critical appraisal for evidence-based practice. 9th ed. *Elsevier, China*. www.googlebooks.co.za (Accessed 2 April 2019).

Logan, J. Nederhoff, D. Koch, B. Griffith, B. Wolfson, J. Awan, FA. Basta, NE. 2018. 'What have you HEARD about the HERD?' Does education about local influenza vaccination coverage and herd immunity affect willingness to vaccinate? *Vaccines.* From: pubmed.ncbi.nlm.nih.gov (Accessed 29 October 2020).

Mahery, P & Slemming, W. 2019. Mandatory childhood immunisation in South Africa: what are the legal options? *South African Journal of Bioethics and Law*. From: https://go.gale.com (Accessed 26 March 2020).

Majola, AM. 2018. Immunization coverage of children aged 12-23 months old n Diepsloot Township, Johannesburg Sub-District A, Gauteng Province, South Africa. From: www.smu.ac.za. (Accessed 24 June 2019).

Makwela, MR. 2018. *Factors contributing to defaulting on expanded programme on immunization vaccines amongst children under 12 months at Stanza Bopape community health centre, Mamelodi in Gauteng province. (Masters Dissertation)*. Pretoria, Sefako Makgatho University. Available from: resipository.smu.ac.za (Accessed 29 March 2020).

Maseti, E. 2015. *Caregivers' perception with regard to vaccine preventable disease. (Masters Dissertation)*. Pretoria, University of South Africa. Available from: uir.unisa.ac.za (Accessed 26 June 2019).

Mathiarasu, AM, Raman, VVA & Arumai, MM. 2017. Prevalence of drop-out rate in measles immunisation coverage among children in Kanyakumari District, Tamilnadu. *International Journal of Public Health Research*. 26-30. From: www.publichealthreview.in. (Accessed 12 June 2020).

Mathibela, F & Skhosana, R. 2019. Challenges faced by parents raising adolescents abusing susbatances: parents' voices. *Social Work (Stellenbosch Online*). From: https://socialwork.journals.ac.za (Accessed 17 May 2021).

Matta, P. El Mouallem, R. Akel, M. Hallit, S & Khalife, MF. 2020. Parents' knowledge, attitude and practice towards children's vaccination in Lebanon: role of the parent-physician communication. *BioMed Central Public Health* 20:1439. From: bmcpublichealth.biomedcentral.com (Accessed 2 December 2020).

McElroy, LM & Ladner, D. 2014. Defining the study cohort: inclusion and exclusion criteria. *Success in Academic Surgery: Clinical trials (131-139).*

Miko, D, Costache, C, Colosi, HA, Neculicioiu, V & Colosi, IA. 2019. Qualitative assessment of vaccine hesitancy in Romania. *Medicina* 55(282):1-19. From: www.googlescholar.co.za (Accessed 2 December 2020).

Motloung, BR. 2016. Immunization coverage in children aged 2-23 months old in Refilwe Township, Gauteng Province. From: www.smu.ac.za. (Accessed 24 June 2019).

Mora, T & Trapero-Bertran, M. 2018. The influence of education on the access to childhood immunization: the case of Spain. *BioMed Central Public Health*. From: publichealth.bomedcentral.com (Accessed 02 March 2020).

Moura, ADA, Brags, AVL, Cameiro, AKB, Alves, ECS, Bates, CMM, Nunes, IH, Figueredo, TWS, Canto, SVE, Garcia, MHO & Teixeira, AMS. Rapid monitoring of immunization to prevent measles in Ceara State, Brazil, 2015. From: www.googlescholar.co.za (Accessed 2 December 2020).

Mphaka, MR. Moshime, MM & Reddy, C. 2018. A cross-Sectional study on caregivers' knowledge, attitude and practices about the routine immunisation program in Tshwane Sub-district 2, Gauteng, South Africa, 2015. *Journal of Environmental Science and Public Health*. scholar.google.com (Accessed 23 January 2020).

Naidoo, N, Railton, J, Jobson, G, Matlakala, N, Marincowitz, G, McIntyre, JA, Struthers, HE & Peters, RPH. 2018. Making ward-based outreach teams an effective component of human immunodeficiency virus programmes in South Africa. *South African Journal HIV Med* 19(1).

Naude, S. 2015. How important is it to have a measles immunization? *Prof Nurs Today* 19(1).

NDOH. 2015. EPI Disease Guideline: Expanded Programme on Immunization in South Africa (EPISA). From: www.health.gov.za (Accessed 10 March 2017).

NDOH. 2016. Links: MomConnect. From: www.health.gov.za (Accessed 24 April 2017).

Ndwambi, A & Govender, I. 2015. Characteristics of women requesting legal termination of pregnancy in a district hospital in Hammanskraal, South Africa. *Southern African Journal of Infectious Disease.*

Ndwandwe, D. Nnaji, CA. Mashunye, T. Uthman, OA & Wiysonge, CS. 2020. Incomplete vaccination and associated factors among children aged 12-23 months in South Africa: An analysis of the South African demographic and health survey 2016. *Human Vaccines and Immunotherapeutics*. www.tandfonline.com (Accessed 19 December 2020).

NICD. 2012. *Vaccine preventable disease: a change in the measles vaccine schedule.* 15. From: www.nicd.ac.za (Accessed 12 April 2018).

NICD. 2016. Vaccine information for parents & caregivers. *Centre for Vaccines and Immunology.* From: www.nicd.ac.za (Accessed 27 June 2018).

NICD. 2017b. Measles alert. 16 March, 2017.From: www.nicd.ac.za (Accessed 25 July 2017).

NICD. 2017a. Measles mass campaign: frequently asked questions. 11 May. 2017. From; www.nicd.ac.za (Accessed 25 July 2017).

NICD. 2019. South Africa certified Polio-free. 1 October, 2019. From: nicd.ac.za (Accessed 28 October 2020).

Noh, J, Kim, Y, Akram, N, Yoo, K, Cheon, J, Park, J, Kwon, YD & Stekelenburg, J. 2019. Determinants of timeliness in early childhood immunization in Sindh province, Pakistan. *BMJ Open.* 1-111. (Peer review). From: www.googlescholar.co.za (Accessed 6 December 2020).

Nsubuga, F, Bulage, L, Ampeire, I, Matovu, JKB, Kasasa, S, Tanifum, P, Riolexus, AA & Zhu, B. 2018. *Factors contributing to measles transmission during an outbreak in Kamwenge*

District, Western Uganda, April to August 2015. From: lis.biomedcentral.com (Accessed 29 September 2018).

Ntshoe, GM, McAnerney, JM, Archer, BN, Smit, B, Harris, BN, Tempia, S, Mashele, M, Singh, B, Thomas, JN, Cengimbo, A, Blumberg, LH, Puren, A. Moyes, JN, Van der Heeven, J, Schoub, BD & Cohen, C. 2013. Measles outbreak in South Africa: epidemiology of laboratory-confirmed measles cases and assessment of intervention, 2009-2011. *Plos One* 8(2). From: journals.plos.org (Accessed 02 January 2018).

Odutola, A. Afolabi, MO. Ogundare, EO. Lowe-Jallow, YN. Worwui, A. Okebe, J. Ota, MO. 2015.Risk factors for delay in age-appropriate vaccinations among Gambian children. *BioMed Central Health Services Research*. From: bmchealthservres.biomedcentral.com (Accessed 13 may 2020).

Oladepo, O. Dipeolu, IO & Oladunni, O. 2019. Nigerian rural mothers, knowledge of routine childhood immunizations and attitude about use of reminder text messages for promoting timely completion. *Journal of Public Health Policy*. From: https://pubmed.ncbi.nlm.nih.gov (Accessed 15 April 2020).

PAHO.2017. Tools for monitoring the coverage of integrated public health intervention: vaccinations and deworming of soil-transmitted helminthiasis. Washington, D.C. From: https://iris.paho.org (Accessed 12 May 2021).

Patel, M, Lee, AD, Redd, SB, Clemmons, NS, McNall, RJ, Cohn, AC & Gastanaduy, PA. 2019. Increase in measles cases-United States, 1 January-26 April 2019. MMWR Morb Mortal Weekly Report 2019. From: http://dx.doi.org (Accessed 25 June 2019).

Peck, M. Gacic-Dobo, M. Diallo, MS. Nedelec, Y. Sodha, SS. Wallace, AS. 2019. Global routine vaccination coverage,2018. *MMWR Mort Mortal Wkly Rep 2019*;68: 937-942 From: cd.gov (Accessed 11 March 2019).

Penfield, T. Baker, MJ. Scoble, R & Wykes, MC. 2014. Assessment, evaluations, and definitions of research impact: A review. From: www.researchgate.net (Accessed 10 May 2021).

Plotkin, SA, Orenstein, W, Offit, PA & Edwards, KM. 2016. Vaccine e-book. From: www.books.google.co.za (Accessed 29 September 2018).

Polit, BF & Beck, CT. 2012. *Nursing research: generating and assessing evidence for nursing practice*. 9th ed. Lippincott.

Portnoy, A, Jit, M, Helleringer, S & Verguet, S. 2018. *Impact of measles supplementary immunisation activities on reaching children missed by routine programs.* Elsevier. From: http://scholar.google.co.za (Accessed 18 May 2018).

Qazi, U, Malika, S, Raza, UA, Saad, M, Zeehan, M & Anwar, S. 2015. *Compliance to timely immunization in an expanded program on immunization center of Pakistan.* From: https://doi.org (Accessed 16 December 2020).

Ramavhoya, TI.Maputle, SM. Lebese, RT. 2015. Knowledge of mothers with regard to immunization of children in Vhembe District, Limpopo Province. J Hum Ecol. From: www.tandfonline.com (Accessed 17 July 2020).

Ramraj, T & Chirinda, W. 2016. District health barometer: immunisation. *Health System Trust.* (Accessed 17 April 2018).

Rasesemola, RR, Matshoge, GP & Ramukumba, TS. 2019. Compliance to the Integrated School Health Policy: Intersectoral and multisectoral collaboration. vol 42(1). From: www.curationis.org.za (Accessed 25 June 2019).

Rasinger, SM. 2013. *Quantitative research on linguistics*. Bloomsbury Publishers PLC.

Reaching Every District (RED). 2017 Revision: A guide for increasing coverage and equity in all communities of African Region. Brazzaville: World Health Organization; 2017. From: www.who.int (Accessed 18 April 2018).

Rosadi, W, Sulaeman, ES & Prasetya, H. 2019. *Multilevel analysis on factors affecting measles rubella immunization uptake among toddlers in Pekanbaru, Indonesia*. 448-460. From: www.googlescholar.co.za (Accessed 20 November 2020).

Rosnow, RL & Rosenthal, R. 2013. *Beginning behavioural research: a conceptual primer.* 7th ed. Pearson Publisher.

Sahu, SK & Singh, TJ. 2016. *Research methodology.* SBPD Publications.

Sarkar, PK. Sarker, NK. Doulah, S & Bari, TIA. 2017. Expanded Programme on Immunization in Bangladesh: A SUCCESS STORY. *Bangladesh J Child Health*. vol 39(2):93-98 www.researchgate.net (Accessed 25 January 2019).

Sartorius, B, Cohen, C, Chirwa, T, Ntshoe, G, Puren, A & Hofman, K. 2013. Identifying high risk areas for sporadic measles outbreak: lessons from South Africa. 174-183. From: https://www.ncbi.nlm.nih.gov/pmc/articles/ (Accessed 17 February 2017).

Shibeshi, ME, Masresha, BG, Smit, SB, Bielik, RJ, Nicholson, JL, Muitherero, C, Shivute, N, Walker, O, Reggis, K & Goodson, JL. 2014. *Measles resurgence in southern Africa: challenges to measles elimination.* From: www.elsevier.com (Accessed 22 February 2017).

Shikuku, DN. Muganda, M. Amunga,SO.Obwanda, EO, Muga, A. Matete, T. Kisia, P. 2019. Door-to-door immunization strategyfor improving access and utilization of immunization services in hard-to-reach areas: a case of Migori County, Kenya. BioMed Central Public Health: 19(1) From: pubmed.ncbi.nlm.nih.gov (Accessed 28 November 2020).

Singh, R & Mangat, NS.2013. *Elements of survey sampling*. Springer.

Singh, S. Sahu, D. Agrawal, A & Vashi, MD. 2019. Barriers and opportunities for improving childhood immunization in slums: A qualitative study. *Preventative Medicine Reports*. From: sciencedirect.com (Accessed 28 December 2020).

South African Early Childhood Review. 2017. Primary level maternal and child health. From: www.researchgate.net (Accessed 27 December 2019).

South African Demographic and Health Survey. 2016. From: www.health.gov.za (Accessed August 2019).

South African Health Review. 2018. *Communicable disease surveillance and outbreak investigation in South Africa.* 92-152. From: www.hst.org.za. (Accessed 12 February 2019).

Srirangam, VB, Kumar, MK, Mukerji, S & Gupta, R. 2017. Socio-economic factors effecting immunisation coverage: focus areas. *Int J Med. Public Health* 7(3).

Srivastava, AK & Shankar, GI. 2017. A study of immunization coverage and its determinants among under five children residing in urban field practice area of S.N. Medical College, Bagalkot, Karnataka, India. *Indian Journal of Forensic and Community Medicine.* From: semanticscholar.org (Accessed 12 January 2021).

Statistics South Africa. 2011. Data by location: Hammanskraal. From: www.statssa .gov.za (Accessed 10 May 2017).

Stop Stockout Project. 2018. Patients turned away as industrial action in North West impacts supply of essential medicines. 30 March 2018. Press statement. From: https://stockouts.org (Accessed 24 August 2018).

Tabana, H, Dudley, DL, Knight, S, Cameron, N, Mahomed, H, Goliath, C, Eggers, R & Wiysonge, C. 2016. *The acceptability of three vaccine injections given to infants during a*

single clinic visit in South Africa. BioMed Central Public Health. From: www.bmcpublichealth.com (Accessed 25 June 2020)

Tagbo, BN, Mwenda, JM, Armah,G, Obidike, EO, Ozumba, UC, Eke, CB, Chukwubuike, C, Edelu, BO, Ezeonwu, BU, Amadi, O, Okke, IB, Nnani, DR, Ani, OS, Ugwuezeonu, I, Ezeblo, SK, Elemuwa, C & Nwagbo, DF. 2014. Epidemiology of Rotavirus diarrhoea among children younger than 5 years in Enugu, South East, Nigeria. *Pediatric Infectious Disease Journal.*

Tavoschi, L, Quattrone, F, De Vita, E & Lopalco, PL. 2019. *Impact of mandatory law on vaccine hesitancy spectrum: the case of measles vaccine catch up activities in Tuscany, Italy.* Elsevier. 7 201-7 202. From: www.googlescholar.co.za (Accessed 2 December 2020).

Torner, N, Solano, R, Rius, C & Dominguez, A. 2015. Implication of health care personnel in measles transmission: the need for updated immunization status in the move towards eradication of measles in Catalonia. *Human Vaccin Immunother*. From:pubmed.ncbi.nlm.nih.gov (Accessed 15 May 2018).

Toure, A. Saadatian-Elahi, M. Floret, D. Lina, B. Casalegno, J & Vanhems,P. 2014. Knowledge and risk perception of measles and factors associated with vaccination decisions in subjects consulting university affiliated public hospitals in Lyon, France, after measles infection. *Human Vaccines & Immunotherapeutics*. From: www.landesbioscience.com (Accessed 12 March 2018).

Trentini, F. Poletti, P. Merler, S & Melegano, A. 2017. Measles immunity gaps and the progress towards elimination: a multi-country modeling analysis. *Lancet Infectious Disease.* From: www.thelancet.com (Accessed 18 June 2018).

Tshwane District Health Information Service (DHIS*).* 2019*. Measles immunisation coverage in Tshwane sub-district 2.* November 2019. Available email: Smangele.Lukhele@gauteng.gov.za.

Van der Ende, K. Gacic-Dobo, M. Diallo, MS. Conklin, lM & Wallace, S. 2018. Global routine vaccination coverage-2017. *MMWR Morbidity and Mortality Weekly Report*. From: pubmed.ncbi.nlm.nih.gov (Accessed 24 August 2019).

Vesikari, T & Van Damme, P (eds.). 2017. *Pediatric Vaccines and Vaccinations: A European Textbook.* Switzerland, Springer international Publishing AG.

Wallace, AS. Krey, K. Hustedt, J. Burnett, E. Choun, N. Daniels, D. Watkins, ML. Soeung, SC & Duncan, R. 2018. Assessment of vaccine wastage rates, missed opportunities, and related knowledge, attitude and practices during introduction of a second dose of measles-containing vaccine into Cambodia's national immunization program. *Vaccine*. From: ncbi.nlm.nih.gov (Accessed 25 November 2019).

Weiss, C. Schrópfer, D & Merten, S. 2016. Parental attitude towards measles vaccination in the canton of Aargau, Switzerland: a latent class analysis. *BioMed Central Infectious Diseases*. From: biomedcentral.com (Accessed 24 June 2018).

Wesseh, CS, Najjemba, R, Edwards, JK, Owiti, P, Tweya, H & Phat, P. 2017. Did the Ebola outbreak disrupt immunisation services? A case study from Liberia. *Public Health Action.* From: http://dx.doi.org/ (Accessed 25 May 2019).

WHO. 2012. Global Measles and Rubella Strategic Plan: 2012-2020. From: www.who.int (Accessed 18 May 2018).

WHO. 2014. Immunization programme that saved millions of lives. 92:309-384. From: www.who.int (Accessed 26 June 2019).

WHO. 2015. Department of Immunization, Vaccines and Biological. *SAGE*. October 2015. From: www.who.int. 294-318 (Accessed 23 March 2018).

WHO. 2016. Department of Immunization, Vaccines and Biological. SAGE. October 2016. From: www.who.int (Accessed 31 March 2018).

WHO.2017. Measles Vaccines: WHO position paper, April 2017 recommendations. From: www.who.int (Accessed 16 April 2018).

WHO. 2019a. Experts caution against stagnation of immunisation coverage in Africa. From: www.afro.who.int (Accessed 23 October 2019).

WHO. 2019b. Ten threats of global health in 2019. Geneva, Switzerland [Internet]. WHO. From: www.WHO.INT/emergencies/ten-threats-to-global-health-in-2019 (Accessed 6 December 2020).

WHO. 2020. Measles and Rubella Strategic Framework 2021-2030. Geneva. From: https://apps.who.int (Accessed 17 May 2021).

Williams, M. 2017. The prevalence of immunization and the factors associated with low immunization prevalence in an urban community in the Western Cape. From: www.uct.aac.za (Accessed 25 December 2019).

Williams, WW. Peng-jun LU. O'Halloran, A. Kim, DK & Fiebelkorn, AP. 2017. Surveillance of vaccination coverage among adult populations-United States, 2015. www.cdc.gov (Accessed 12 May 2018).

World Health Statistics. 2020. Monitoring health for the sustainable development goals. Geneva, World Health Organization, 2020. From: www.who.int (Accessed 23 December 2019).

Zewdie, A. Letebo, M. Mekonnen, T. 2016. Reasons for defaulting from childhood immunization program: a qualitative study from Hadiya zone, Southern Ethiopia. *BioMed Central Public Health*. From: bmcpublichealth.biomedcentral.com (Accessed 20 May 2019).

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RESEARCH ETHICS COMMITTEE: DEPARTMENT OF HEALTH STUDIES

REC-012714-039 (NHERC)

6 December 2017

Dear Charmaine Koketso Mogotsi

Decision: Ethics Approval

HSHDC/796/2017

Charmaine Koketso Mogotsi

Student No.:5651-749-1
Supervisor: Mr MT Mamahlodi
Qualification: MPH
Joint Supervisor: -

Name: Charmaine Koketso Mogotsi

Proposal: Measles immunization coverage and dropout rate on children under 14 years in the City of Tshwane

Qualification: **MPCHS094**

Thank you for the application for research ethics approval from the Research Ethics Committee: Department of Health Studies, for the above mentioned research. Final approval is granted from 6 December 2017 to 6 December 2019

The application was reviewed in compliance with the Unisa Policy on Research Ethics by the Research Ethics Committee: Department of Health Studies on. 6 December 2017

The proposed research may now commence with the proviso that:

1) *The researcher/s will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.*

2) *Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study, as well as changes in the methodology, should be communicated in writing to the Research Ethics Review Committee, Department of Health Studies. An amended application could be requested if there are substantial changes from the existing proposal, especially if those changes affect any of the study-related risks for the research participants.*

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3) *The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study.*

4) *[Stipulate any reporting requirements if applicable].*

Note:
The reference numbers [top middle and right corner of this communiqué] should be clearly indicated on all forms of communication [e.g. Webmail, E-mail messages, letters] with the intended research participants, as well as with the Research Ethics Committee: Department of Health Studies.

Kind regards,

Prof JE Maritz
CHAIRPERSON
maritje@unisa.ac.za

Prof MM Moleki
ACADEMIC CHAIRPERSON
molekmm@unisa.ac.za

Prof A Phillips
DEAN COLLEGE OF HUMAN SCIENCES

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E-mail: Robert.Oyedipe@gauteng.gov.za

TSHWANE RESEARCH COMMITTEE: CLEARANCE CERTIFICATE

MEETING: 12/2017
PROJECT NUMBER: 34/2018
NHRD REFERENCE NUMBER: GP_201803_024

TOPIC: Measles Immunization Coverage and Dropout Rate on Children between 6 Months and 14 Years in the City Of Tshwane, Hammanskraal.

Principal investigator:	Ms Charmaine Mogotsi
Supervisor:	Mr. M T Mamahlodi
Facility:	Tshwane District sub-district 2
Name of the Department:	UNISA

NB: THIS OFFICE REQUEST A FULL REPORT ON THE OUTCOME OF THE RESEARCH DONE AND

NOTE THAT RESUBMISSION OF THE PROTOCOL BY RESEARCHER(S) IS REQUIRED IF THERE IS DEPARTURE FROM THE PROTOCOL PROCEDURES AS APPROVED BY THE COMMITTEE.

DECISION OF THE COMMITTEE: APPROVED

.....
Dr. Robert Oyedipe
Acting Chairperson: Tshwane Research Committee
Date: 2018.05.03

.....
Mr. Pitsi Mothomone
Chief Director: Tshwane District Health
Date: 08.05.2018

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REPUBLIC OF SOUTH AFRICA

Annexure 1

DECLARATION OF INTENT FROM THE PHC MANAGER FOR TSHWANE PROVINCIAL CLINICS

I give preliminary permission to Ms **Charmaine Mogotsi** to do his or her research on **"Measles Immunization coverage and dropout rate on children between 6 months and 14 years In the City of Tshwane, Hammanskraal."** in **Tshwane District Sub-district 2**

I know that the final approval will be from the Tshwane Regional Research Ethics Committee and that this is only to indicate that the clinic/hospital is willing to assist.

Other comments or conditions prescribed by the PHC Manager to the Researcher are

Mr. M. MAKHUDU
PRIMARY HEALTH CARE: TSHWANE
Date: 2/5/2018

Appendix 1: QUESTIONNAIRE

Name of the interviewer:	Unique ID:

NAME OF CLINIC: _____

(*Please note that this name will not be mentioned during data analysis and interpretation, it is only for follow up purposes if needs be)*

SECTION 1: (PART 1 AND PART 2) For both Parents and Guardians

(You as a parent or guardian are hereby requested to engage in an interview with the interviewer. Please choose the most appropriate answer to the following questions. Please note that your responses are strictly confidential. Your name will not be written on this data collection tool as indicated on information sheet.)

PART 1: Demographic Details (Please *choose the correct answer)*

1. How old is your child**?**
   - ✓ 6-11 months
   - ✓ 1-4 years
   - ✓ 5-9 years
   - ✓ 10-14 years
2. Indicate your child's gender
   - ✓ Male
   - ✓ Female
   - ✓ Other
3. Level of education for parents/guardian:
   - ✓ No Schooling
   - ✓ Matric
   - ✓ Degree/Diploma
   - ✓ Postgraduate

4. Parents/guardian employment status :
   - ✓ Unemployed
   - ✓ Self-employed
   - ✓ Employed

PART 2: **Knowledge of child's measles immunization program.**

(You as a parent or guardian are hereby requested to engage in an interview with the researcher. Please tick the most appropriate answer to the question. Please note that your responses are strictly confidential. Your name will not be written on this data collection tool as indicated on information sheet.)

1. Are you a parent to this child?	yes	no
2. Do you know what measles is?	yes	no
3. Do you know the importance of immunizing your child against measles	yes	no
4. Do you know the age group for measles vaccination?	yes	no
5. Do you know that your child may not be allowed to school if she/he is not fully immunized?	yes	no
6. Do you know that a child with a rash, runny nose and red eyes might be having measles?	yes	no
7. Have you ever been returned from your local clinic due to lack of measles vaccines?	yes	no
8. Do you take your child (ren) to the random mass immunization campaigns when they are available?	yes	no
9. Do you know that failure to vaccinate your child may have negative health impact?	yes	no
10. Is your child fully immunized (age-appropriate) for measles?	yes	no

SECTION 2 :(PART 1 only) measles immunization status checklist

(In this section, the interviewer will check the presence or absence of the following through observation of the Road to health Card)

Serial number		Yes	No	Catch up
1	Road-to-Health-card/booklet available			
2 2.1	1st dose Immunized at 6 months			
2.2	1st dose immunized at 9 months			
2.3	1st dose never being immunized			
3 3.1	2nd dose Immunized at 12 months			
3.2	2nd dose immunized at 18 months			
3.3	2nd dose never being immunized			
4	Not immunized at all			

Please tick the appropriate box: General Comment. The child is:

- ✓ Fully immunized
- ✓ Partially immunized
- ✓ Unimmunized

Thank you for your time.

Appendix 2: INFORMATION SHEET FOR PARTICIPANTS.

Reference number: HSDCD/796/2017

MEASLES IMMUNIZATION COVERAGE AND DROPOUT RATE ON CHILDREN BETWEEN 6 MONTHS AND 14 YEARS IN THE CITY OF TSHWANE, HAMMANSKRAAL.

Purpose of the research

Measles immunization is the most important public health strategy to eliminate measles outbreak we experience as a country. To succeed in that we need parents who are willing to assist by ensuring that their children are fully immunized for measles.

The purpose of this research is to determine measles immunization status, dropout rate and assess knowledge, attitude and perception caregivers of children between 6 months and years in the City of Tshwane, Hammanskraal.

Participant Selection

You are being invited to take part in this research because the researcher feels that your experience as a parent/guardian can contribute much to the understanding and knowledge of measles immunization activities.

Risk and Benefit

You will have to share your personal and confidential information or feel uncomfortable about things you have to share. You are not forced to partake in the study or to answer uncomfortable questions. There will be no direct benefit to you, but your participation is likely to help us find out more about the immunization coverage and drop-out rate in your area. There will be no personal financial gain for participants, the researcher or the University.

Procedures

I am asking you to help me learn more about measles immunization and, if you accept the invitation to form part of this research, you will be asked to participate by answering a questionnaire in a form of an interview for about 30 minutes to give your thoughts and view on immunization, and your child's RTHC will be checked for measles immunization status. I am

interested to know the reasons why you choose to access/not access immunization services through the clinics

The discussions will take place in english language, at a place convenient to you and the researcher will be the available to assist you. You will not be victimized or penalized if you refuse to complete this questionnaire as it is completely voluntary. The questionnaire will be in a form of interview, and no-one will be identified by name. The information saved on a tape record is confidential, and no one else except my Supervisor, Mr T Mamahlodi, and statistician will have access to the records. The tape record will be destroyed 24 months after collecting the information.

.

It would be appreciated if you could kindly participate and co-operate with the researcher.

For any queries please contact:

Researcher: Name: Ms Koketso Mogotsi
Contact details: 076 402 3834
Email address: 56517491@mylife.unisa.ac.za

Supervisor: Name: Mr T Mamahlodi,
Contact details 012 429 6757,
Email address: mamhmt@unisa.ac.za.

UNISA Ethics Committee: Name: Mrs H Du Toit
Contact details: 0124296303
Email address: dtouiths@unisa.ac.za

Appendix 3: INFORMED CONSENT FORM

Participant Unique ID………………..

Statement concerning participation in a Research Project:

MEASLES IMMUNIZATION COVERAGE AND DROP-OUT RATE ON CHILDREN BETWEEN 6 MONTHS AND 14 YEARS IN THE CITY OF TSHWANE, HAMMANSKRAAL.

I have read the information and heard of aims and objectives of the proposed study and was provided the opportunity to ask questions and given adequate time to rethink this issue. The aim and objectives of the study are sufficiently clear to me. I have not been pressured to participate in any way.

I understand that participation in this study is voluntary and that I may withdraw from it at any time and without supplying reasons. This will have no negative influence on my family or me. I know that the Tshwane District Research Committee and the University of South Africa Research Ethics Committee (Reference Number: HSHDC/796/2017) have approved this study. I am fully aware that the results of the study will be used for scientific purposes and may be published. I agree to this, provided my privacy is guaranteed.

I hereby give consent to participate in the study.

. . . .

Name of participant   signature of participant

. . . .

Place   Date   witness

Statement by Researcher

I provided verbal and written information regarding this study.

I agree to answer any future questions concerning the study as best as I am able.

I will adhere to the approved protocol

. . . .

Name of researcher   signature   date   place

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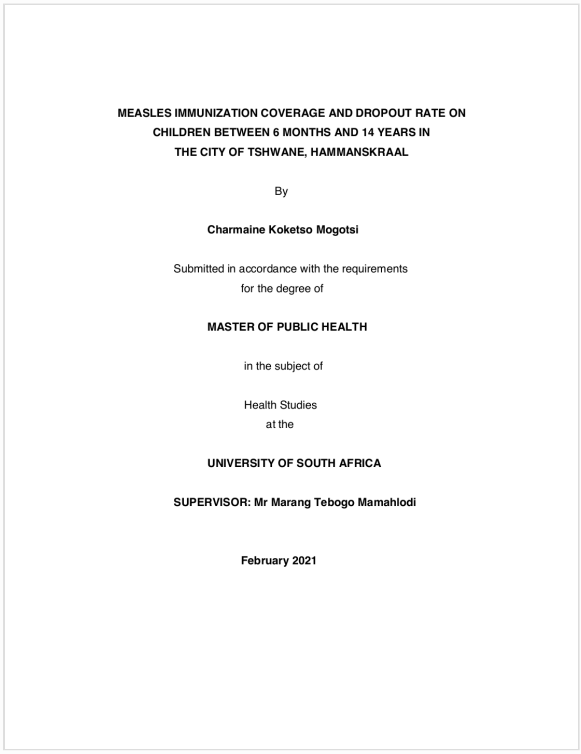

MEASLES IMMUNIZATION COVERAGE AND DROPOUT RATE ON CHILDREN BETWEEN 6 MONTHS AND 14 YEARS IN THE CITY OF TSHWANE, HAMMANSKRAAL

By

Charmaine Koketso Mogotsi

Submitted in accordance with the requirements for the degree of

MASTER OF PUBLIC HEALTH

in the subject of

Health Studies at the

UNIVERSITY OF SOUTH AFRICA

SUPERVISOR: Mr Marang Tebogo Mamahlodi

February 2021

LET'S EDIT

EDITING CERTIFICATE

22 January 2021

TO WHOM IT MAY CONCERN

DECLARATION: Editing of Masters in Public Health Dissertation

I, Christelle van der Colff, professional, qualified and practising editor, hereby confirm that I proofread, formatted and edited the style, layout (numbering, pagination and heading format), references (reconciliation of citations and the accompanying reference list) and language (spelling, grammar, punctuation, consistency) of a research proposal for **Charmaine Koketso Mogotsi** titled **MEASLES IMMUNISATION COVERAGE AND DROPOUT RATE IN CHILDREN UNDER 14 YEARS IN CITY OF TSHWANE**. I did no structural rewriting of the content. Editing done was from chapter 1 to the end of the reference list. Changes were suggested in track changes and Charmaine Koketso Mogotsi has the prerogative to accept, delete or change amendments made by the editor before submission. I am, therefore, not accountable for any changes made to this document by Charmaine Koketso Mogotsi or any other part subsequent to my edit. The edited work described here may, therefore, not be identical to the final copy submitted for examination purposes.

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